

MU120 POM

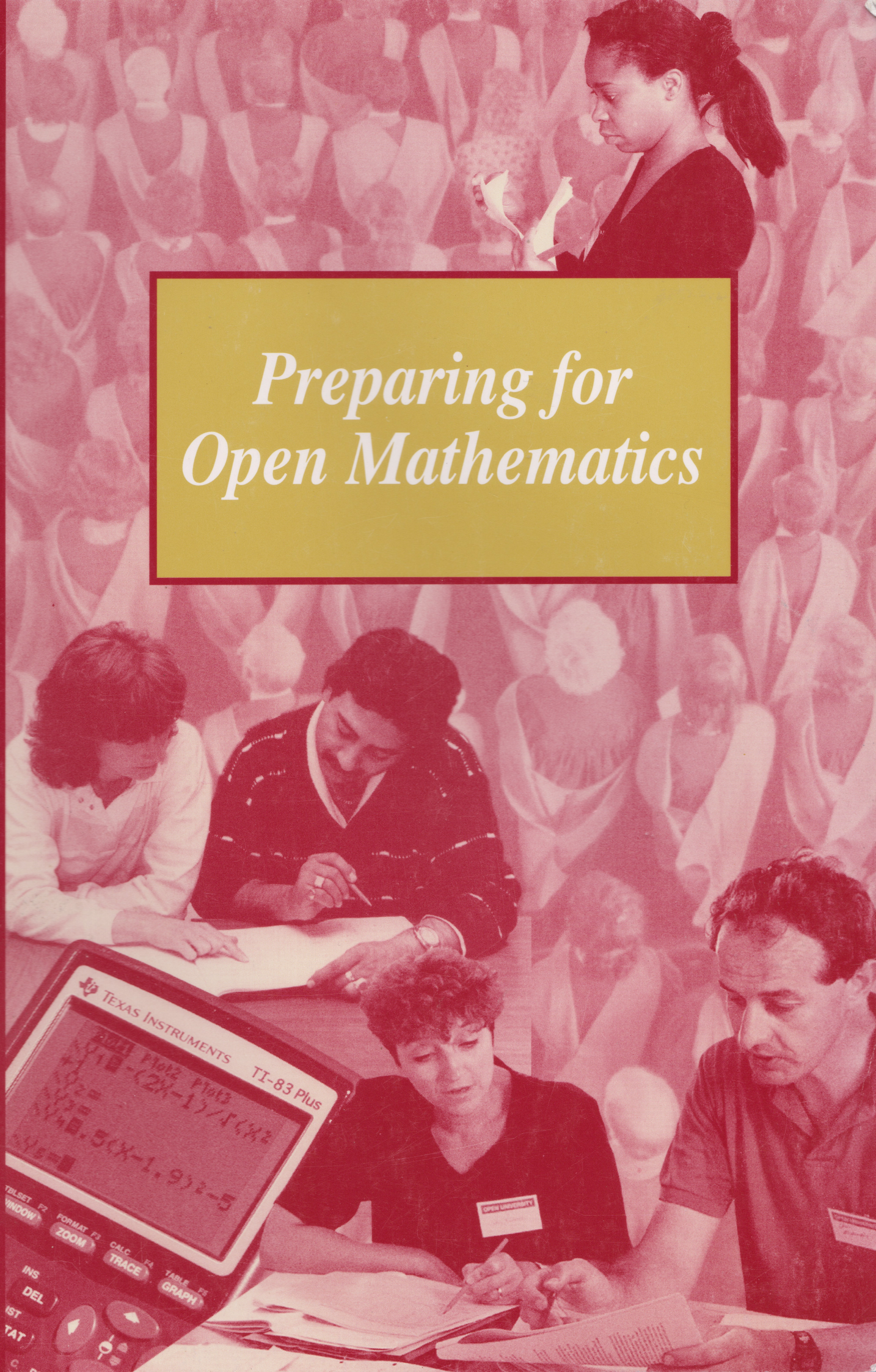


The Open
University

Mathematics
and Computing
A first level
multidisciplinary
course

Open Mathematics

Preparing for Open Mathematics





The Open
University

Mathematics
and Computing
A first level
multidisciplinary
course

Open Mathematics

Preparing for Open Mathematics

Prepared by the course team

The MU120 preparatory materials were produced by:

Gaynor Arrowsmith
Margaret Crowe
Judith Daniels
Judy Ekins
Barrie Galpin
Kathleen Gilmartin
Joyce Johnson
Karen Rex
Pip Surgey
Jane Williams

The preparatory package makes use of materials originally prepared for use with the Open University course M101, in particular the work of Ian Harrison, Dave Sargent and Lynne Burrell (née Graham).

Other contributions to the text were made by a number of Open University staff and students and others acting as consultants, developmental testers, critical readers and writers of draft material. The course team are extremely grateful for their time and effort.

The preparatory materials were put into production by the following:

Course Materials Production Unit (Faculty of Mathematics and Computing)

Martin Brazier (Graphic Designer)	Sue Dobson (Graphic Artist)
Hannah Brunt (Graphic Designer)	Roger Lowry (Publishing Editor)
Alison Cadle (T _E XOpS Manager)	Diane Mole (Graphic Designer)
Jenny Chalmers (Publishing Editor)	Nazlin Vohra (Graphic Designer)

The Open University, Walton Hall, Milton Keynes, MK7 6AA.

First published 1995. Second edition 1996. Third edition 2000.

Copyright © 2000 The Open University

All rights reserved; no part of this publication may be reproduced, stored in a retrieval system, transmitted or utilised in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without written permission from the publisher or a licence from the Copyright Licensing Agency Ltd. Details of such licences (for reprographic reproduction) may be obtained from the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 0LP.

Edited, designed and typeset by The Open University, using the Open University T_EX System.

Printed and bound in the United Kingdom by Henry Ling Limited, at the Dorset Press, Dorchester, Dorset.

ISBN 0 7492 9730 1

Contents

Introduction	5
Study guide	6
1 Approaching your preparation	8
1.1 Structure of the preparatory package	9
2 The Diagnostic Quiz	11
2.1 What the quiz is for	11
2.2 Starting work on the quiz	11
2.3 Planning your strategy	12
2.4 Tackling the remainder of the quiz	13
3 Why prepare?	15
3.1 Studying with the audiotape	15
3.2 Study Planning	19
4 Starting to study mathematics	20
4.1 Your study conditions	20
4.2 Making notes	22
4.3 Active learning	24
4.4 Using a reader article	27
5 Making friends with your calculator	30
5.1 Where to begin?	30
5.2 Why a calculator?	32
5.3 When to use the calculator	35
6 Planning your study sessions	38
6.1 Starting to study a unit	38
6.2 Making the most of a study session	39
7 Assessment: computer-marked assignments	45
7.1 Revising powers of ten and scientific notation	46
7.2 Doing a CMA	46
7.3 Filling in the CMA form	49
7.4 Receiving your feedback letter	51
8 Consolidating study skills	52
9 Communicating mathematics	54
9.1 Writing mathematics	55

10	Writing solutions to tutor-marked assignments	60
10.1	Completing the <i>Preparatory Resource Books</i>	60
10.2	The format of TMA questions	61
10.3	Approaches to problem solving	65
10.4	Writing out solutions	66
10.5	TMAs and your study of MU120	75
10.6	Receiving your marked TMA script	78
11	Studying and learning mathematics	80
12	Outcomes for the preparatory package	83
13	What next?	84
13.1	Active reading, viewing or listening	84
13.2	Consolidation	84
13.3	The first course mailing	85
13.4	Starting MU120	86
13.5	Sources of help	86

Introduction

This book is the core of a preparatory package designed to help you to prepare to study the course MU120 *Open Mathematics*. This package aims to:

- ◇ give you some idea of the demands made by studying an Open University course;
- ◇ introduce you to the different teaching methods used;
- ◇ revise some basic mathematical skills;
- ◇ help you to be ready to tackle the course when it starts.

This book is similar to the 16 ‘units’ of MU120 which are printed and bound in a similar way. It will guide you through the other materials in the package and the first three sections will help you to plan your work. You should plan to study the package over a number of weeks, between now and the start of the course.

The preparatory package is not designed to be worked on at one sitting. It contains advice about study interspersed with mathematical revision sessions from the *Preparatory Resource Books*, each of which could take you anything from minutes to hours to complete, depending on how familiar you are with the material. You should aim to spread your work on the package over as long a period as possible: *do not leave it all until the last week!*

This book, like all the units in the course, begins with what is called a ‘Study guide’. The Study guide is a short section that tells you in a few paragraphs what lies ahead: which course components you will need, what the unit is about and how you might go about tackling it.

Study guide

The diagram opposite shows the components of the preparatory package. From it, you will see that the route through the package consists of reading the thirteen numbered sections from this book in parallel with working through modules of the *Preparatory Resource Books* (RB). The diagram also shows when you will need to study the other components of the package. The diagram contains many icons; these are to help you to identify those components needed in a particular section. These icons are also used in the MU120 units, not only in Study guide diagrams but also at the start of each section (to indicate which components you will need during your study of that section) and at appropriate points within sections. The meanings of all the icons used in the course are given below.

Normally you should study the sections in the order in which they appear in a unit; but if you need to change that order—for example, if you cannot listen to an audiotape when you reach an audio session in the text—the diagram will help you to plan a logical alternative route. Arrows between boxes indicate that sections are linked and show where you *need* to study one section *before* another; for example, you should not study Section 10 until you have studied both Section 7 and Section 9.



Audiotape and player



Videotape and player



Resource book



Calculator



Map



Calculator book



Diagnostic quiz



Readings



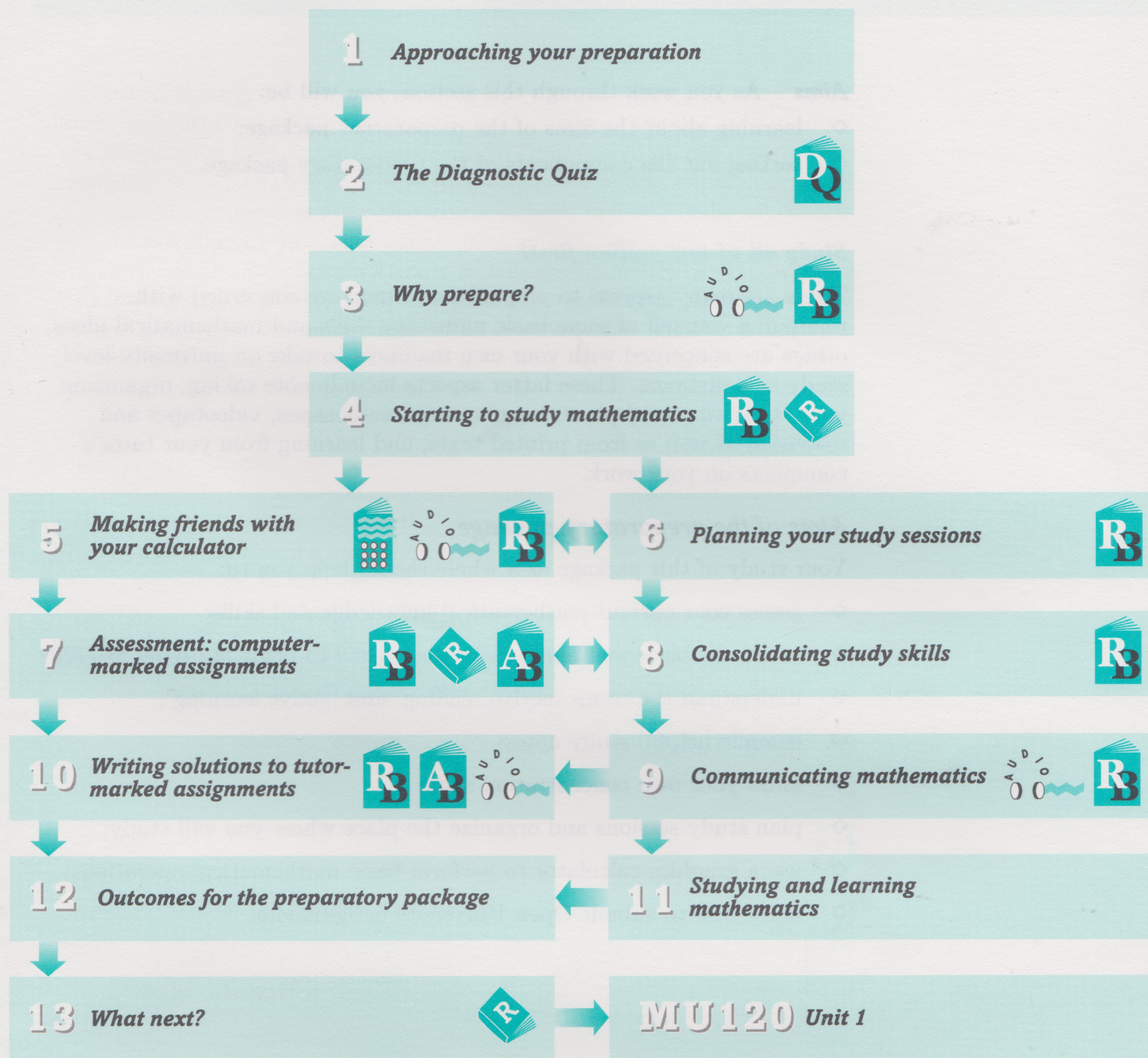
Learning file



Assignment booklet



Activity sheet



The structure of the preparatory package

1 *Approaching your preparation*

Aims As you work through this section, you will be:

- ◇ learning about the aims of the preparatory package;
- ◇ sorting out the components of the preparatory package.

Study all of this section first!

There are many aspects to preparation. Some are concerned with reminding yourself of some basic numeracy skills and mathematical ideas; others are concerned with your own readiness to take on university-level study at a distance. These latter aspects include note taking, organizing your study time and place, learning from audiotapes, videotapes and television as well as from printed texts, and learning from your tutor's comments on your work.

Aims of the preparatory package

Your study of this package as a whole should help you to:

- ◇ assess your current mathematical knowledge and skills;
- ◇ revise the basic mathematical skills needed to begin studying MU120;
- ◇ understand the terms 'active reading' and 'active learning';
- ◇ compile helpful study notes;
- ◇ know your own concentration span;
- ◇ plan study sessions and organize the place where you will study;
- ◇ use a graphics calculator to perform basic mathematical operations;
- ◇ know how to submit Open University assignments.

1.1 Structure of the preparatory package

The package includes the following materials:

- Preparing for Open Mathematics* (this book)
- Diagnostic Quiz and Solutions
- Activity Sheets
- Preparatory Resource Books* (two volumes, A and B)
- Calculator Book* (Chapter 1)
- Preparatory Readings (reader)
- Preparatory Assignment Booklet
- Stop Press
- Preparatory audiotape
- CMA (computer-marked assignment) form and CMA return envelope
- A TMA (tutor-marked assignment) form

The complete *Calculator Book* will be included in a later mailing.

A Contents Checklist contained in the preparatory mailing gives a complete list of all the items you should have received. It also tells you what to do if anything is missing.

You may have received other mailings already, from various parts of the Open University. Unless you sort them carefully as they arrive, you may soon find you have a huge heap of papers and that too much of your study time is spent just searching through them for the one you want!



Activity 1 Keeping track

Check that you can find all the items listed above. Decide where you are going to keep your Open University materials, and clear a space for them.

Sort the materials you have received so far, for example classifying them 'for immediate action', 'for action later in my preparation', 'for reference', and so on. Make sure that you have somewhere to keep your MU120 course work and notes.

Look back at the diagram on page 7 and check that you understand how the sections are linked together and which section uses which course components.

Activity 2 What's it all about?

Talking to someone else or to yourself is a good way of clarifying your own ideas.

If there is someone you can talk to about your MU120 studies, ask them to listen to you. If not, pretend that you are talking to someone or writing a letter. Then describe your preparatory package to that person.

You might try it as follows.

- (a) Show them the package and tell them about the different components of it, the way they link together and the aims of the whole package.
- (b) Tell them about your system for keeping and finding all your OU materials.
- (c) Ask them if they understand what you have told them and, if not, try to clarify your own thoughts and discuss the things they didn't understand or things which you feel you need to clarify for yourself.

Outcomes

Now that you have completed your study of this section, you should be able to:

- ◇ describe the different components of the preparatory package;
- ◇ describe the aims of the preparatory package in your own words.

You should also have allocated a place to keep all your Open University material and devised a system for finding individual items easily.



2 *The Diagnostic Quiz*

Aims As you work through this section, you will be:

- ◇ assessing your current mathematical skills, using the Diagnostic Quiz;
- ◇ planning a piece of work.



2.1 *What the quiz is for*

MU120 is intended to be understood and enjoyed by students who have not had much previous experience of mathematics. However, familiarity with some topics is assumed. These include measuring, basic arithmetic, bits of geometry and understanding diagrams and graphs—the sort of mathematics you see in newspapers and meet in everyday situations. If your numeracy skills are a bit rusty, you may need to do some revision before the course starts.

Before you can start your preparation in earnest, you need to discover what mathematics you know already, and feel confident using, and which topics you need some help with. The best way of doing this is by working through some problems and seeing how you get on. The preparatory package contains the Diagnostic Quiz, which consists of a series of questions on topics that are important for you to understand before MU120 starts. The purpose of the quiz is to identify those topics you need to concentrate on.

You will probably find that you have met some of these topics before. However, as it is important that you can handle this level of mathematics confidently, do try the quiz, whatever your mathematical background is. The quiz will highlight any difficulties you may have and then suggest a way of overcoming them so that you will feel more confident and comfortable when starting MU120.

In completing the quiz and working through the solutions, you will begin to develop an extremely important skill for studying and learning on your own: this skill is assessing yourself as a learner of mathematics. By doing the quiz and using the solutions to provide feedback, you should begin to appreciate what is involved.

2.2 *Starting work on the quiz*

Initially, you should just try the first section of the quiz, taking as much time as you like—do not try to rush through it.



Activity 3 Quiz time

Find the Diagnostic Quiz booklet and the blue Handbook Activity Sheets for reference. Read the instructions for the quiz and try the questions in Section 1. You should tackle the questions seriously, aiming to work out and write down solutions whenever you can.

If you find you can't even understand a question, don't worry for now—make a note of it and move on to the next one.

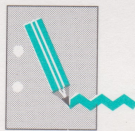
Note down those questions you find difficult, those which take a long time and those where you don't feel confident even if you can get an answer.

When you have done all you can of Section 1 of the quiz, check your answers in the Diagnostic Quiz Solutions, again making a note where your answer differs from the given answer or where you found the printed solution difficult to follow.

Once you have tackled the first section, you should see how the quiz and the solutions can give you an idea of the topics you need to study. The Diagnostic Quiz Solutions will guide you to the appropriate modules in the *Preparatory Resource Books* for help with these topics. You will find more details about using the results of the quiz in the next section.

2.3 Planning your strategy

Before you tackle the rest of the quiz, spend a little time thinking about your work on the first section of it in Activity 3—not about the mathematics itself but about the way you tackled it—and use those ideas to help you with the rest of the quiz.



Activity 4 Planning ahead

Make a note of anything that hampered you in doing Activity 3. Were you interrupted? Did you wish you had set aside more time? Were you short of paper? Did you need time to mull over ideas between questions? Now find the cream-coloured Activity Sheet called 'Quiz schedule', and use it to plan your work on the rest of the quiz, by filling in the first two columns of the table on the sheet. Don't expect to be able to do the rest of the quiz in a single session, or even in a single day.

Times will vary widely, but you should allow about four hours for doing the quiz and checking your solutions.

2.4 Tackling the remainder of the quiz

Activity 5 Completing the quiz



Following your schedule, try to do the rest of the questions in the quiz and check your answers. Remember the guidance at the beginning of the quiz about questions involving the calculator—you can leave those until later if you have not used a calculator before or if you haven't got one yet.

When you have checked the solutions to each section, complete the appropriate row of the schedule on the Activity Sheet. If you need to spend more time on a topic, make a note of the reference to the *Preparatory Resource Books*, which you will find in the Diagnostic Quiz Solutions.

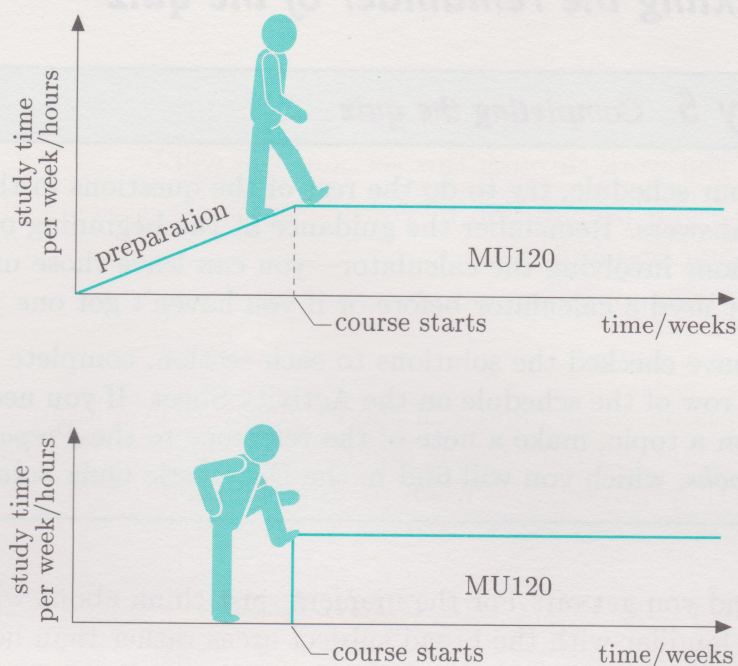
Well, how did you get on? For the moment, just think about whether or not you are familiar with the broad subject areas rather than how accurate your answers were.

If you did identify some of the mathematics as 'weak areas', you will need to include some work on the *Preparatory Resource Books* in your plans. However, even if you feel you need do no more work on *mathematical* topics, you may still be well advised to do some preparatory work before the course begins.

As well as helping you to develop your mathematical skills and techniques, you will find that this package introduces other important skills associated with studying and learning mathematics. For example, can you:

- ◇ present a mathematical assignment in an appropriate form?
- ◇ organize study sessions effectively?
- ◇ plan your study sessions over a week or fortnight, including times when you will tackle an assignment?

As you work through this preparatory package, you will begin to develop these skills so that you are able to study and learn from MU120 more effectively. You will also be introduced to mathematics using a variety of different materials such as audiotape. You can check the different things you should be able to do when you have completed your preparatory work for MU120 by referring to the list of outcomes in Section 12. So, whether you found the quiz easy or not, do explore all of the preparatory package before the course starts. Whatever your previous background, building up your study via this package will provide a gentle 'study ramp', rather than a sudden step.



Studying MU120 with and without preparation

If you found large parts of the quiz difficult, then you should be prepared to spend quite a lot of time working carefully through this package. The audiotape session in the next section will help you to plan your preparation.

Outcomes

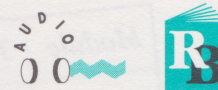
Now that you have completed your study of this section, you should have:

- ◇ worked through the Diagnostic Quiz, section by section;
- ◇ checked your answers with the Diagnostic Quiz Solutions and made a note of where you found difficulties with the question or the printed solution;
- ◇ assessed your current mathematical knowledge and skills relevant to your study of MU120.

3 *Why prepare?*

Aims As you work through this section, you will be:

- ◇ planning your preparation by considering some students' thoughts about their preparation;
- ◇ working through an audiotape.



This section is based on band 1 of the Preparatory Audiotape. Speakers on the audiotape will refer to the diagrams on the next few pages as *frames* and they will tell you when to stop the tape to work on an activity.

3.1 *Studying with the audiotape*

To help you to find places on the tape, you may like to use your machine's counter, if it has one. You should set the counter to zero when you start to play the tape and you can record the reading at key points, such as the end of each band. Then you can find where to start when you use it the next time. If your machine does not have a counter, you could make marks on the scale on the front of the cassette.

It should take you about forty minutes to work through this band. Apart from this book, you will need:

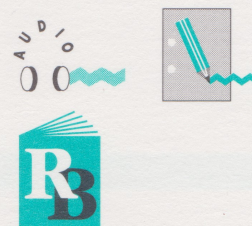
- ◇ your own solutions to the Diagnostic Quiz, and any notes or comments you made;
- ◇ the Quiz schedule you completed for Activities 4 and 5, and the two other activity sheets for the Preparatory Audiotape, Band 1, headed 'Prep. to do' and 'Study timetable';
- ◇ a pen or pencil to write on the sheets and spare paper for making notes;
- ◇ the 'Preparatory Audiotape' and a tape player.

You may also wish to have the *Preparatory Resource Books* handy.

If you get interrupted while working through the tape, just 'pause' the tape and continue later. You will also be asked to pause the tape to carry out activities as you work through.

One advantage of learning from an audiotape is that you can study at your own pace and pause or rewind to repeat parts if you lose concentration or find something unclear the first time. So take your time and start the tape when you feel ready.

Now turn over the page to the frames and listen to band 1 of the Preparatory Audiotape.



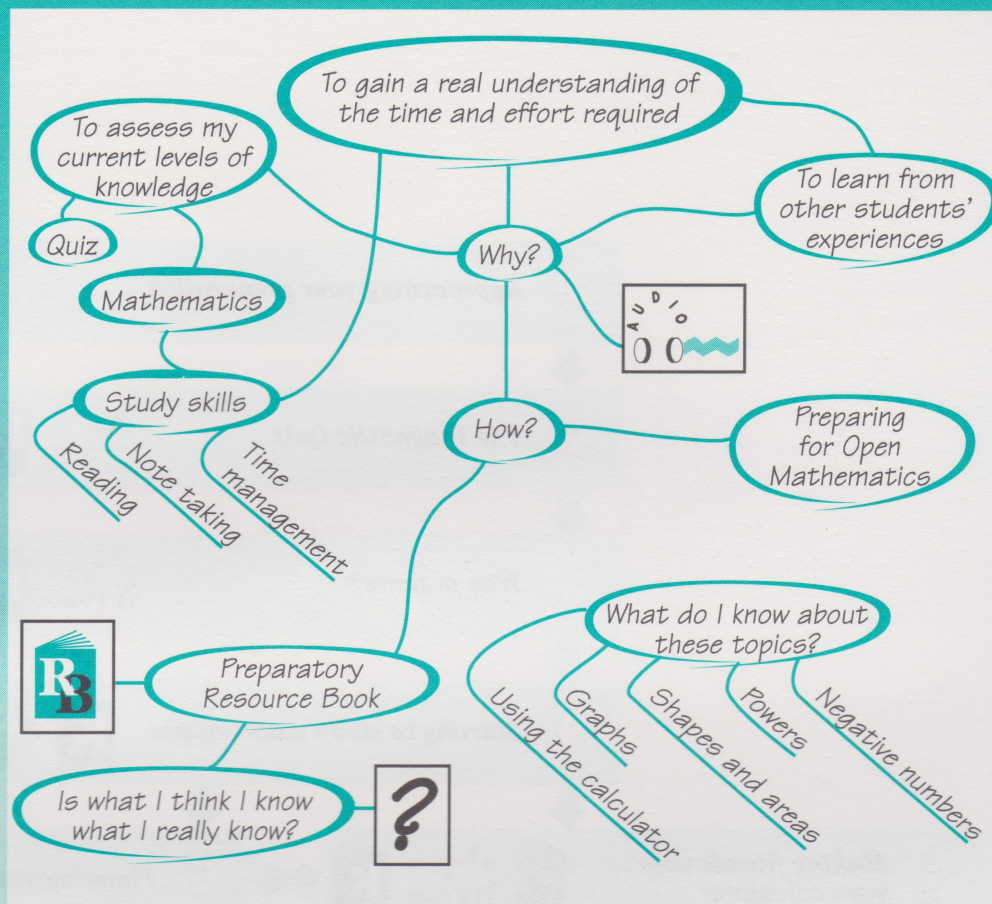
Frame 1

Module	Topics	Level of knowledge	Amount of work
1	size of numbers units of measurement arithmetic	<i>Yes, I feel confident with this.</i>	<i>I shall skim this and just do the exercises.</i>
2	rounding estimation checking your answers	<i>This looks familiar but I could do with more practice.</i>	<i>I just need to study the last part of this module.</i>
3	ratio proportion percentages	<i>I can recollect this vaguely.</i>	<i>I'll have to work through this in detail.</i>
4	squares, cubes and roots powers scientific notation	<i>I've never studied this in depth before.</i>	
5	scale diagrams tables and charts graphs	<i>I've seen this before but I've forgotten it.</i>	
6	language notation formulas		
7	shapes and symmetry areas and volumes angles		

Frame 2



Frame 3



Frame 4

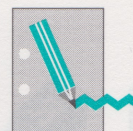
MU120 preparation summary

Preparatory Resource Book	Preparing for Open Mathematics	Quiz	2 sessions
Units of measurement	Study skills		
Arithmetic	Reading		
Estimation	Note taking		
Graphs	Planning time	Calculator Book	4 sessions?
Geometry	Learning mathematics		
•	•		
•	•		
•	•	Reader	
8 × 2 sessions	10 sessions		

32 sessions = about 5 weeks?
Allow for holiday, etc.—say 7 weeks

3.2 Study Planning

Activity 6 Preparatory study timetable



Draft out a study timetable of your own to cover the period from now until you start MU120. There is an Activity Sheet headed 'Study timetable', and referred to as Sheet 2 in the audiotape, that you may find useful, or you may prefer to structure a timetable for yourself. You will probably need to modify and update it as time goes by.

If you are studying this package fairly close to the start of the course and your preparation timetable looks too daunting to fit in before then, please bear in mind that the *Preparatory Resource Books* can be used as a resource throughout the year.

Outcomes

Now that you have completed your study of this section, you should have:

- ◇ completed your self-assessment of the topics covered in the Diagnostic Quiz, indicating your level of existing knowledge on each;
- ◇ assessed the amount of work you will need to do on each topic before MU120 starts;
- ◇ planned roughly how you will cover these topics in the time left before the course starts;
- ◇ identified activities that you will rearrange or replace by your study of the MU120 preparatory package and the course itself;
- ◇ used the diagram of the structure of the preparatory package to understand how the sections are linked together.

You should also be able to:

- ◇ organize the resources needed for a study session involving an audiotape;
- ◇ use diagrams like those in the tape frames and tables like those on the Activity Sheets to plan future study activities.

4 Starting to study mathematics



Aims As you work through this section, you will be:

- ◇ deciding where to study;
- ◇ thinking about the best conditions for study;
- ◇ studying and making notes on Module 1 of *Preparatory Resource Book A*;
- ◇ beginning to think about how you learn;
- ◇ learning from a Reader article;
- ◇ checking your understanding of the following mathematical topics:
 - whole numbers, decimals, fractions and negative numbers;
 - comparing the sizes of numbers;
 - units of measurement;
 - basic arithmetic for whole numbers, decimals, fractions and negative numbers.

You may, of course, have studied recently, either another Open University course, or elsewhere. If you feel that your way of studying works well for you, you probably only need to skim read those parts of this section that look at study conditions and planning.

4.1 Your study conditions

First, think about the conditions that would be best for you to study MU120. What times are you going to set aside for study? Where are you going to do your studying? It's unlikely that you'll find the 'perfect' place to study with plenty of working and storage space, ideal temperature and lighting, privacy, with endless unbroken hours of time to study! In fact these may not always be the best conditions for studying mathematics anyway. There will be times when you will need to think and write quietly on your own for one or two hours at a time. However, continuous, solitary, sedentary work may become tedious and isn't always effective. The odd time snatched on a bus, a train, or while gardening can be invaluable for thinking over new ideas.



Nor does study always need to be a solitary activity—you can help yourself by talking about mathematics—to anyone and everyone! Putting the ideas into words can work wonders for your understanding. Apart from other MU120 students and your tutor, it may help to talk to friends or family about your work. Certainly, if you do, it may help them to feel part of your study. Even if there is nobody who will listen while you put your ideas into words, many students find that they can talk to the goldfish, the cat, or even an imaginary person. In fact, discussion can be an important part of learning—it not only helps you to organize your ideas but also challenges your thinking.

When you worked through the Diagnostic Quiz, you may have realized that you need to set aside time for studying on a regular basis. A major part of any week's study will involve using the various components of the course: text, calculator, audio, video, and so on. Most units are meant to be studied over one or two weeks, allowing for roughly seven or eight hours of study each week.

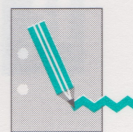
You may think that reading a unit will not take you very long, but working through this type of text is not the same as reading a novel or a newspaper. Look through the pages of this book and the *Preparatory Resource Books* and think about the differences between this material and the text of a story or magazine. Think about the conditions under which you might best study the material.

Activity 7 Getting ready

Either write down or discuss your current thinking about the following.

- ◇ Where will I read and write?
- ◇ Where will I listen to and watch audio and video?
- ◇ Which of my usual activities (such as walking, ironing, gardening, driving) will allow me time to mull over ideas for the course?
- ◇ Who will listen when I talk about mathematics?

You may want to look back at your responses on the Activity Sheet headed 'Study timetable'. You could record your answers on the 'Getting ready' Activity Sheet, or make other notes—whatever suits you best.



When learning on your own you may find that you work better if you organize your time in periods of between half an hour and a couple of hours. If you decide you have to work for longer periods, take short breaks while you move around or have a drink. As well as your course materials, you will need paper and writing implements (or a computer), your calculator and sometimes access to an audiotape player, a television and video equipment.



4.2 Making notes

Your next study task involves Section 1.1 of *Preparatory Resource Book A*. Use this opportunity to experiment with making notes. You may want to use a variety of ways of making notes depending on the particular course component you are working on, so it is a good idea to practise these as you work through this preparatory package.



Activity 8 Some mathematical study

Now study some mathematics, bearing in mind the conditions under which you have chosen to study. Work through Section 1.1 of *Preparatory Resource Book A*, making some notes as you do so. If possible, you should aim to study the whole of Section 1.1 in a single study session. For some students, this may be a very short study session, but others may need to do a lot more. Make sure that you write down some notes about the main ideas you meet, especially any which are new to you or which you had forgotten.

Well, that was your first bit of mathematical study for MU120! Now quickly make a note of how long it took you. Was this longer or shorter

than you expected? Was the work relatively easy or difficult? When planning study time, it can be useful to allow up to half as much time again as you think you will need, in case of the unexpected, such as getting stuck or having to cancel a session.

You will come back to other aspects of studying mathematics later but, for the moment, concentrate on the notes you made.

How did you make your notes? Did you use diagrams or just words or a mixture? Have you decided what you will do with your notes? It's very important to add a heading for the notes as you do them so that you will know what they refer to later! Some students use an exercise book; others prefer loose-leaf paper, which is then filed, others use a computer for making notes. It is worth thinking about *where* you will keep your notes as well at this stage.

You may have written your notes in the text itself. You might underline words or phrases or use a fluorescent marker, and perhaps add some notes in the margin. Doing this, whether or not you make other notes, means you can see the important points on a page when you need it again. You might like to experiment with some form of annotation to pick out points in this book as you work through the preparatory package. It is important to see the course texts as workbooks rather than textbooks. You should feel free to write in them so that they form a permanent record of your learning and course work.

Here are some examples of notes on parts of this section made by a student. Your notes may be briefer than these. The important thing is that you can use your notes, not that they look perfect.

Place value

The column headings help you to compare numbers.

Millions	Hundreds of thousands	Tens of thousands	Thousands	Hundreds	Tens	Units
	1	0	5	6	7	1
		1	5	8	2	3

For decimals, you can extend the column headings to the right, as far as you want: tenths, hundredths, This really helps when you compare decimal numbers.

Fractions

$$\frac{3}{10} \quad \begin{array}{l} \leftarrow \text{numerator} \\ \leftarrow \text{denominator} \end{array}$$

Equivalent fractions can all be simplified to the same simple fraction.

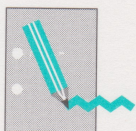
$$\frac{100}{300} = \frac{1}{3} \quad \frac{8}{24} = \frac{1}{3} \quad \frac{2}{6} = \frac{1}{3}$$

Some activities in the texts have associated printed sheets for your notes. These sheets are of two types:

Cream-coloured Activity Sheets. Some activities in the units are specifically designed to help you think about your learning of mathematics. Printed response sheets are provided for these activities with suggestions for notes and planning your learning.

Blue-coloured Handbook Activity Sheets. These sheets are for you to create your own mathematical handbook of terms and techniques. There are four of these included with the preparatory material and others for each unit of the course.

When there is an Activity Sheet for you to use you will usually see an icon like this alongside the activity in the text.



4.3 Active learning

The way that you make notes from the text is closely allied to the way in which you read the text. Studying with distance-learning materials involves developing skills in using text and other components. You may have found already that doing things with the text is often more effective than just reading it—this is often called ‘active reading’.

So how did you study or read Section 1.1 of *Preparatory Resource Book A*? Take a few minutes to think about your response. Did you only think, or did you make notes on the pages or elsewhere? Did you read it through carefully, skim through it to find out what was there, read only the bits that seemed less familiar to you? On the other hand, did you use a combination of different ways? All of these can be very effective. The course aims to help you to develop effective learning techniques to use in the future.

Can you suggest when it is very important to be involved in active reading and learning and when it may be reasonable to read in a more passive way? Stop now and consider this briefly before reading on.

For many ideas and techniques, you need to be actively involved. If you have some background material that provides a context or ‘sets the scene’, then this could be read in a more passive way. For example, your reading of the Study guide of this book could be quite passive, whereas your reading of the mathematical material, particularly if it is not familiar to you, would need to be more active.

Here are some ways of keeping your learning active while you read the course texts:

- ◇ doing the activities and exercises included in the text;
- ◇ asking your own questions: for example, ‘What do I already know about this topic?’ or ‘What are the main ideas developed through this section?’;

- ◇ making notes in the margins or underlining or highlighting key ideas in the text;
- ◇ jotting down a summary of the work you have done during a study session and using it to begin your next session;
- ◇ using diagrams and sketches to help clarify ideas and make them 'your own' or drawing a 'spider diagram' to show how the ideas are related;
- ◇ trying to keep in mind the aims and hoped-for outcomes for the material you are working on. (These are always listed at the beginning and end of each section.)

Two different approaches to studying a section of the *Preparatory Resource Books* are described below.

Student A settles down to an indefinite and undefined period of study, beginning by reading the contents list and the introduction. Noting the advice in it, she conscientiously tackles in turn all the 'Try these first' questions at the start of Section 1.1 with varying success, according to previous familiarity. Then she checks the answers so that she can decide which subsection to read next. Finding that she got two questions wrong, she goes straight to revise these topics. She studies the appropriate subsections, working through the examples. Then, encouraged by success, she proceeds happily with all the 'Try some yourself' questions.

Student B, knowing that he has half an hour to spare which he wishes to use productively, quickly skims through the 'How to use this book' section and notes the purpose of diagnostic questions: 'Try these first'. Then he looks at the contents of Module 1 and flicks through to find out what it covers and decides that he can only manage a few pages in the time. Looking more closely at the module, he annotates the text with some useful examples, which put the arithmetic in context. After only five minutes, he decides that he remembers most of what he has been taught previously about numbers and arithmetic, but he particularly wants to know about negative numbers. He now has a question in mind, 'What is a negative number?', and starts in some detail to find out. He reads thoroughly the subsection on negative numbers and notes some points to think about, at which point his half hour is up and he makes a note to work at the 'Try some yourself' exercises at the next opportunity.

Can you identify with either approach? You will probably study in both these ways on different occasions. In both cases, you identify the question that needs to be addressed and thus the direction that your learning is taking. To help you in developing a 'sense of direction' it is useful to take an overview of the module or section before you begin to study it and ask yourself questions, such as the following.

- ◇ What do I need in order to study this section? (In MU120, you might need to work with a videotape or an audiotape, for example.)
- ◇ What are the aims and outcomes of the section? (That is, when you have completed your study of the section, what should you be able to do, know or understand?)

Activity 9 *Reflecting on your study*

You are shortly going to study what you need from the rest of Module 1 in the *Preparatory Resource Book A*. How are you going to begin? What is the module about and what do you hope to learn from it?

Take a few minutes to think about these questions and note down your responses. Remember that you are likely to be confident about some of the material already.

Before you study the rest of Module 1, here are some points that some students have found useful in the past. Think about which of them could be helpful and appropriate to you.

- ◇ Always study with an objective in view and a question in mind. Course units are not magazines and browsing alone does not help much.
- ◇ Read with a pen in your hand, or near a computer if you find word-processing easier. Do each activity as you come to it and check your response against any comments given in the text.
- ◇ Make notes while you are studying. A summary of key words and ideas, including page references, might be useful.
- ◇ Detailed working of exercises can help you to remember ideas, but you may feel that your notes are sufficient if you have annotated the text.
- ◇ Skim read first to get an overview of the work that you propose to tackle. Estimate the time it will take.
- ◇ Don't spend too much time working through parts that you already confidently understand.
- ◇ Read key sections of the text first and go back over them if you need to, to build up knowledge and ideas.
- ◇ Regardless of how much (or little) you write in the course of your study, keep your work, including worked examples, all together. This is likely to help considerably when you do your assignments and the end-of-course assessment.
- ◇ To help you to review your work as you go along, look back at your last piece of work before starting the next. In addition, you could practise your powers of recall by trying to remember what you read in previous sections, by looking at your notes and by working (or reworking) some of the exercises.



Activity 10 *Starting to study in earnest*

Study the rest of Module 1 of *Preparatory Resource Book A*, taking it slowly, section by section, bearing in mind the above points.

Activity 11 *Looking back*

Look back over your work on Module 1. Have you learned anything new?

Do you feel that you now understand most of the content of the module? In other words, can you do all of the things specified in the 'Outcomes' list at the end of the module and do you feel that you could apply them in a different situation? If not, you should return (possibly after a break) to any things you feel you have not mastered. Make a list of any topics you think require extra work.

Check through your notes: do the topics seem familiar? If not, add them to your list of topics requiring further work.

4.4 *Using a reader article*

Finally, in this section, practise rather different reading skills by studying a reader article from the Preparatory Readings booklet. If you have already spent several hours on this section, you might like to leave this last part until later. On the other hand, if you found Module 1 easy, you may find the reader article an interesting and useful alternative.

Activity 12 *Reader article*

Read the reader article 'Some uses for digital codes', by Stephen Barnett, from the Preparatory Readings booklet. Bear in mind the ideas from Section 4.3 about active learning. In particular look quickly through the article to give yourself an overview before you start to read in detail. There is a useful summary at the end of the article which you may like to read *first*. As you read through the article, make notes on each section in such a way that you can use them later to remind yourself of the main points.



The next activity tests how useful your notes are at reminding you of the main points. Read through the activity now and then find a suitable time, preferably with a listener, to complete it.

Activity 13 *Explaining to someone else*

Look at the notes you made on the reader article.

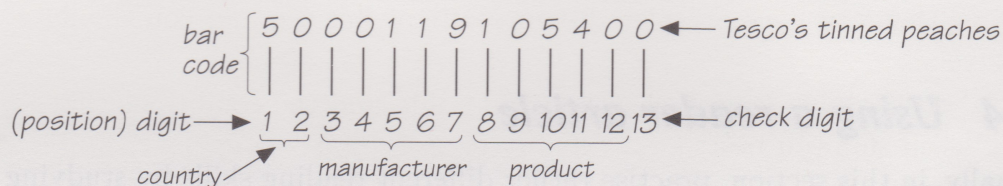
Choose the section of the article that you found most interesting.

Use your notes to remind yourself of the main points concerning the use of codes in this context.

Explain to someone else (or imagine how you might do so) the use of codes in the context you picked. If there were points where your explanation became hazy, refer back to your notes or to the reader article itself in order to clarify the points.

Consider your notes on this section and think about whether you could have improved them at all to make them more useful. Look at the example of a student's notes, below, and see if they give you any good ideas to use in the future.

Bar codes (European Article Numbering)



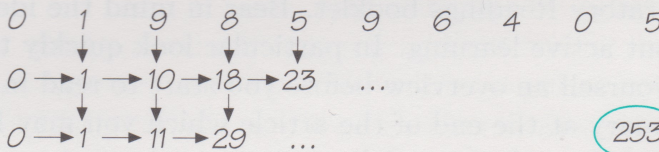
Checking the check digit: add all the odd position digits; add all the even position digits and multiply this answer by 3. Add the two answers together—the answer should be a multiple of 10 if there have been no errors.

$$(5 + 0 + 1 + 9 + 0 + 4 + 0) + 3 \times (0 + 0 + 1 + 1 + 5 + 0)$$

$$= 19 + 3 \times 7 = 19 + 21 = 40 = 4 \times 10, \text{ so the check digit is correct.}$$

ISBNs

To check the ISBN first write it down as a row of digits. Then add two more rows of digits both starting with zeros. Build up the other numbers as shown. The final, circled, number must be a multiple of 11 if the ISBN is correct.



253

This is a multiple of 11

You will have noticed that at the end of each section of this book there is a list of expected outcomes. Similar lists occur at the end of the sections of the units in the main course. Try to establish the habit of using these lists to assess your learning, as suggested in the next activity.

Activity 14 Looking at outcomes

Look at the outcomes below and check whether you have achieved them. Discuss what you have learned with someone else, if possible. If you feel you have not achieved all the outcomes, re-read parts of the relevant text. If there are still some topics which you are unsure of in Module 1, add them to your study timetable (Activity 6).

Outcomes

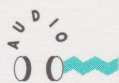
Now that you have completed your study of this section, you should have:

- ◇ decided where and when you will study and the conditions that will suit you best;
- ◇ studied as much as you need of Module 1 of *Preparatory Resource Book A*;
- ◇ read the reader article 'Some uses for digital codes'.

You should now be better able to:

- ◇ understand whole numbers, decimals, fractions and negative numbers;
- ◇ compare the size of two numbers;
- ◇ use correct units of measurement;
- ◇ perform, and explain, basic arithmetic operations using both positive and negative numbers;
- ◇ make notes on mathematical topics that you study;
- ◇ use your notes to remind yourself of a topic, so that you can explain, in your own words, the main points to someone else;
- ◇ reflect upon your own learning processes, including the manner in which you 'actively read' to enhance your understanding.

5 Making friends with your calculator



Aims As you work through this section, you will be:

- ◇ starting to become familiar with your calculator;
- ◇ planning your calculator work alongside the rest of your preparation;
- ◇ developing some ‘good practice’ in relation to calculator use;
- ◇ learning how the calculator fits in with the rest of the course.
- ◇ checking your understanding of the following mathematical topics:
 - rounding and estimation;
 - the order of operations;
 - use of brackets;
 - rounding answers appropriately;
 - checking your answers;
 - squares and powers.

You will need the recommended course calculator before you can study this section. Details of how to get it should have been sent to you. If necessary go on to Section 6 and come back to this as soon as you have your calculator.

You are *not* expected to be familiar with all the features of the calculator before you start the course (in fact, you will not use all its facilities even by the time you finish the course!), but you may begin to appreciate its advantages, even when using it for basic arithmetic.

5.1 Where to begin?

In some of the questions in the Diagnostic Quiz, you were asked to use a calculator. If you had not used a calculator before, you were advised to skip those questions in the quiz for the time being. But you are probably getting impatient to unpack and try out your new calculator.

Take your calculator out of its box and have a quick look at it. (No need to switch it on yet!) Now find the accompanying calculator manual and flick through it, to see how it is organized. (No need to read it yet!) You will *not* be using the manual to learn how to use the calculator, though much later in the course you may find it useful for reference purposes.

You will be beginning to appreciate that there is a lot to learn about your calculator. It will take a long time to get to know how to use its many facilities. In this section, you will focus on using it to do arithmetic; but, even in that limited role, you will find that it is a powerful tool with many advantages. If you are reasonably familiar with calculator usage, you will probably find that you can work through this section quite quickly, but do not skip it altogether—you will still need to get to know *this* calculator and revise the relevant mathematical techniques. If you have not used a

calculator (much) before, you will probably want to take more time getting used to it and spread out your preparatory work on the calculator, perhaps coming back to it between studying the remaining sections of this book.

Included in the preparatory package is Chapter 1 of the *Calculator Book*, which will help you to learn about different aspects of your calculator. However you choose to study this material, do aim to complete the first four sections of Chapter 1 and the calculator questions of the Diagnostic Quiz before the course starts. But do *not* expect to become an expert on the calculator all at once—you will have plenty more time and opportunity to get to know it as the course progresses.

Activity 15 Planning your calculator work

Read the Introduction to the *Calculator Book* and then turn to Chapter 1: 'Exploring your calculator'. Look at the first four sections, which should be studied before the course starts. Band 2 of the Preparatory Audiotape covers the work done in Section 1.1 and the first two subsections of Section 1.2, and you may find that using the audiotape gets you started more quickly.

Now plan when you will work on the first four sections of Chapter 1 of the *Calculator Book*. Be cautious in your planning to ensure that you get a good understanding of the work covered before contemplating going further. You may like to add your planned study of the *Calculator Book* to your study timetable (Activity 6) now.



Activity 16 Getting started

Work through Sections 1.1 and 1.2 of the *Calculator Book*. Band 2 of the Preparatory Audiotape talks you through most of these two sections so you can choose whether to use the book itself or the audiotape or both. When you are working from the book, make sure that you try all the exercises. There are answers and comments at the back of the book to refer to once you have tried the exercises for yourself. You will also find some puzzles and investigations in the *Calculator Book* called 'Brain stretchers'. These are not essential to the course but do try them out in order to broaden your understanding—or simply for fun!



5.2 Why a calculator?

The course makes use of a calculator in order to help you to learn and understand the mathematics in the course—a calculator is *not*, as some people still seem to believe, a substitute for learning mathematics. In fact, using a calculator can enable you to see the underlying mathematics more readily in several ways. For example:

- ◇ instead of getting engrossed in performing long, sometimes tedious calculations, you can focus your attention on the problem you are actually trying to solve;
- ◇ you can work with more realistic and interesting examples, rather than having only over-simplified, artificial examples that can be solved by hand;
- ◇ you can see the results and relationships displayed graphically without the time-consuming chore of plotting graphs by hand.

All the calculator work for MU120 is included in the *Calculator Book*. You will learn how to use each facility as you need it in the course—the course units will refer you to the book whenever you need to do something new with your calculator, or for calculator exercises. As the course progresses you will be using it for statistics, graphs and tables, modelling, and simple programming, as well as for arithmetic.

Here are some students' reactions to using the course calculator.

The calculator makes calculations fun. You can see the calculation laid out on the screen, you can correct any mistakes easily, and it does complicated calculations so quickly.

I like the pictures and graphs—a picture means so much more to me than a formula.

I like to be able to store numbers, formulas and simple programs in the calculator and I am still amazed to discover that they are still there next time I turn on the calculator.

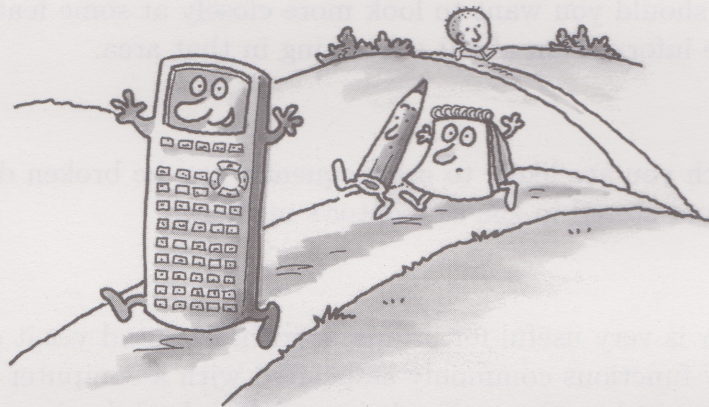
I like the layout of the keyboard, all the numbers together away from the more advanced keys.

It saves me so much time. I like to feel that I have all that power in my pocket!

All these students have their own favourite aspects of the calculator and, as you get to know yours, you will develop your own preferences. Some advantages of the course calculator are given below, but as you work with the calculator you may well find other useful aspects to add to the list.

Speed

The calculator takes the tedium out of long calculations with numbers that would be fearsome to do in your head or time-consuming to do with pencil and paper. For example, the calculator takes about the same time to multiply 123.57 by 0.598 as to do 2×2 : that is, a fraction of a second. 'Long division is a thing of the past for me now I have a good calculator', said one student. 'It will add, subtract, multiply, divide numbers and lots more, in the blink of an eyelid. It saves me so much time on long calculations.'



The screen

You can see the calculations that you have entered as well as the answers. This means you can easily check whether you have made any mistakes.

Editing

You can correct mistakes in the input for a calculation easily and investigate what happens if you change one number in the calculation; for example, the interest rate or the price of an article.

Accuracy

The calculator does not make mistakes in the way that human brains tend to. Human fingers do, however, make mistakes sometimes; and the calculator may not be doing what you think you have told it to do. So correcting errors and estimating the approximate size of answers are important skills in double-checking your calculator calculations. (Just as they are for checking calculations done in your head or on paper!)

Memory

The calculator retains numbers, formulas and programs which you have stored in it, even when it is turned off. You can recall them when you need them and so save time by not having to enter the same information again.

Information

The calculator will give you information about any number that you have entered: for example, its square or cube, its square root or cube root. It will also give you information about a whole list of numbers: for example, the mean (average) or the highest value in the list.

Graphs and diagrams

Lists of numbers (numerical data) or formulas can be illustrated by diagrams or graphs. You can choose the scale that you want the calculator to use and you can magnify an interesting area of a graph (referred to as 'zooming in') should you want to look more closely at some feature or get more accurate information about something in that area.

Programs

Routines which you are likely to use frequently can be broken down into simple steps and stored in the calculator's memory.

Flexibility

The calculator is very useful for ordinary arithmetic and yet it can also perform many functions commonly associated with a computer and deal with quite advanced mathematics. It is useful for both beginners and experts alike, because it has a variety of modes of operation.

Ease of use

Most aspects of the calculator are straightforward to use. Calculations are entered on the screen in the same order as you would write them down. More complicated mathematical functions and features are also reasonably intuitive, and there are 'escape' mechanisms, so that you can explore without worrying about how you will get back to where you were.

Convenience

The calculator is small and slips conveniently into a bag or pocket. You will be able to carry it around with you and use it unobtrusively as and when you want—perhaps in a shop, on a train or in a restaurant.

Power

The calculator is a powerful tool and has several modes of operation: arithmetic, statistical, graphical, programming, and so on. In this respect it is like a computer with a number of different packages. However, it is in general rather simpler to use than a computer.

5.3 When to use the calculator

Despite the list of advantages given, here is a word of warning: *a calculator is not a substitute for a brain!* Even when you are using your calculator, you will still need to sort out what calculation to do to get the answer to a particular problem. However skilled you are at using your calculator, if you do the wrong sum, you will get the wrong answer. The phrase ‘garbage in, garbage out’ applies just as much to calculators as to computers. Your calculator is just that—a calculator!

It will not replace your number sense either. The skills of estimating answers in your head and knowing when the answer you get is reasonable are even more important when using a calculator. It is very easy to press the wrong key by mistake and you need to be able to tell when *you* have made an error.

So the calculator is not a substitute for thinking: it is a tool to help you to expand the range of problems that you can tackle. You will need to use it in conjunction with other tools, such as pencil and paper and you will always need to think about what you are doing. The answer from your calculator may be an accurate calculation of what you entered, but you need to use your head to ensure that what you put in was what was required. You also need to interpret the output from the calculator in the relevant situation.

As you have already seen in Section 1.2, the Calculator Book often encourages you to use your head as well as your fingers: see for example, the ‘Guess and Press’ exercise. Here are some more guidelines to help you to use your calculator sensibly.

- ◇ Do simple calculations in your head: entering them into your calculator would take more time.
- ◇ Use the calculator for calculations where you would be liable to make a mistake or where it would take a long time to do them in your head and/or with pencil and paper.
- ◇ When solving a problem, write down what you are doing on paper and check that you are doing the right calculation for your particular problem.
- ◇ Estimate the rough size of your answer, so that if you get something very different you will be alerted to a possible error in your input to the calculator.
- ◇ Always check that your input is correct as it appears on the screen and amend it if necessary.

Since checking and estimating are so important in calculator work, before going any further with the calculator, you should make sure your estimating skills are up to scratch!



Activity 17 Estimation

Work through those parts of Module 2 of *Preparatory Resource Book A* that you feel unsure about. The amount of time this takes will depend on your responses to the Diagnostic Quiz, but do at least have a look through the material before carrying on. Note down, on your 'Prep. to do' sheet both the areas where you are now confident and any that you would like to return to later. Include those that you wish to return to later on your study timetable.



Activity 18 More calculations

Work through Sections 1.3 and 1.4 of the *Calculator Book*. There are plenty of optional Brain stretchers here which should provide practice using your calculator, so that you feel confident in using it for arithmetic calculations before the course starts. Make a note of any difficulties or queries you have, and also note things that go well. If you are unsure about squares and powers, you may like to postpone your study of Section 1.4 until you have worked through Modules 3 and 4.

If you missed out any of the calculator questions in the Diagnostic Quiz earlier, try them now.

If you have time you may be able to get ahead and work through Sections 1.5–1.7 of the *Calculator Book*, which are associated with the first unit of the course. But do not be too ambitious! You may need to postpone studying some of this material until you meet the related topics in the *Preparatory Resource Books* or in *Unit 1*.

Activity 19 Taking stock

Now that you are a good way through studying the preparatory package, you should re-assess your plans for the rest of your preparatory work. Look at the plans you made in Section 3, particularly your study timetable, and the notes that you have added to them. Amend them as necessary.

If you are ahead of schedule, you could plan additional activities. If you are a bit behind schedule, you may need to set aside more time per week to complete all the necessary work before the course starts.

If there are a number of topics with which you had problems, then consider seeking help or advice from your tutor, once you have been allocated one.

Activity 20 Monitoring your progress

Check that you have achieved the outcomes below and discuss your progress with someone else, if you find it helpful.



HOW'S THE OPEN UNIVERSITY GOING, HARRY?

Outcomes

Now that you have completed your study of this section, you should have:

- ◇ worked through some of Chapter 1 of the *Calculator Book*;
- ◇ planned the remainder of your calculator work and integrated it into your overall preparatory study plans.

You should also be able to:

- ◇ explain some elements of 'good practice' for using your calculator, including when to use it and when not to use it;
- ◇ estimate the size of answer expected for a calculation as a check against mistakes;
- ◇ perform arithmetic operations using your calculator;
- ◇ round your answers to an appropriate number of decimal places or significant figures;
- ◇ check that your answers make sense.

6 *Planning your study sessions*



Aims As you work through this section, you will be:

- ◇ considering how you plan your study session effectively;
- ◇ monitoring and assessing your progress;
- ◇ thinking about your methods of studying and learning;
- ◇ checking your understanding of the following mathematical topics:
ratio, proportion and percentages.

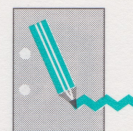
In Section 4, you probably tackled the study of Module 1 and the reader article sequentially—that is, you worked through the material in the order it appeared. However, this may not always be the most appropriate or effective way in which to work on a unit. It is often a good idea to start a section or a unit by looking at its overall structure and, after you have sorted that out, to go through the text in detail.

6.1 *Starting to study a unit*

Each unit of the course begins with a Study guide, which advises you on how to study the unit. For example, it tells you which materials you will need (such as video or audiotape), so that you can make sure that you have the necessary equipment ready when you start studying. Each Study guide has a diagram showing the structure of the unit. This makes it easy for you to see the unit as a whole before you start and you may find it useful to refer back to it during your study. Reading the Study guide and referring closely to the diagram should help you to plan your study of the unit.

Look back at the Study guide at the front of this book. There are icons there to show which course components you will need for each section and the particular tasks you will be doing, such as reading an article. These icons are repeated at the start of each section of the materials, and at the relevant point in the text. In addition, the Study guides in each of the course units give you an estimate of the number of hours it will take to study each section.

A unit for MU120 is usually scheduled to be studied over either one or two weeks. (The Course Calendar will make this clear, when you get it with your next mailing.) It will probably help you if you think about organizing your study time so that you have between six and eight hours available for studying per week, including time to complete the assignments. You may like to think about how you can include your OU work in your weekly schedule and organize your study of this preparatory package as practice for the real thing. You may find it helpful to build up your study time gradually to about six to eight hours a week before the course starts. Then, as the course progresses, check out how long the work is taking you, and change your plans if you need to.

Activity 21 *Finding time for study*

Draw up a schedule of the regular activities in your life that you carry out during a two-week period. Now allocate around twelve hours for OU study. You may find it easier to schedule blocks of time, say between one and two hours. Think about where these study sessions are going to 'fit' into your week, and how they may affect other things in your life.

An Activity Sheet headed 'Finding time' has been supplied, but feel free to make an alternative plan. First list the tasks that you carry out regularly, including work and personal commitments. Then make a note of when you could put time aside for OU study; for example, Mondays from 6.30pm to 8.30pm. Now add up the time that you have. If it is more than twelve hours per fortnight, then this is enough to get you started on the course. If it is less than this, you will need to think about rearranging or cancelling some things that you normally do, or asking for some extra help. Good luck!

Activity 22 *How long?*

Look at Module 3 of *Preparatory Resource Book A*. Decide which parts of it you will need to study and divide these into study sessions. Then fit the study sessions into the schedule that you drew up in Activity 21.

6.2 *Making the most of a study session*

You should now be ready to begin to study Module 3. You are going to be involved in working on some mathematics, but at the same time try to think about this particular study session. Depending on your circumstances it may be a short or long period of continuous study and it may be the first of several sessions devoted to Module 3. Before you begin consider the following questions.

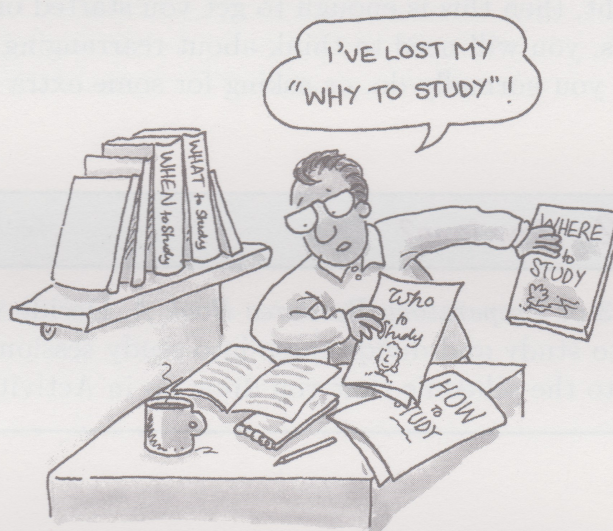
- ◇ What materials and equipment do you need? Are they with you now?
- ◇ Are you comfortable in the place where you are studying?
- ◇ Are you able to concentrate on the task in hand?
- ◇ Do you know what you are going to study and why?



Activity 23 Onward and upward

Work through your first study session on Module 3.

Before you finish the session, allow yourself enough time to stop and think briefly about *how* you studied. Write some notes to describe the session. For instance: how did you begin? Did you take a break? Did you get stuck? How did you get going again, or did you stop? Did you make notes? Where did you put them? Did you try to make your learning active? Were you able to assess whether you were learning? How did you feel when you had finished?



It can be useful to think about where you are at the start of each study session. This could mean looking at what you achieved in previous study sessions and what you plan to do now. By actively thinking about and planning what you are learning, you are likely to gain more from your sessions. This may seem cumbersome and time-consuming to start with, but it will soon become part of your regular study routine. After all, these are the sorts of mental processes that most people carry out on a day-to-day basis. For example, before you go shopping, you probably think about what you need, whether you have enough money, time, and so on. In the same way it makes sense to think about and plan study sessions carefully.



Activity 24 Finishing Module 3

Study the rest of Module 3. Use the plan you made in Activity 22, modified if necessary, and bear in mind the points made in Section 4.3 about active learning.

When you have finished, have another look at your study timetable (Activity 6) and revise it if necessary.

Activity 25 Under consideration

Consider the following six questions, and make brief notes if you think they would be helpful.

Have you enjoyed your study?

Did your concentration wane at all?

Did the work take longer than you had expected?

Can you remember what you have read?

Do your notes help you to recall what you have read?

Has your study so far led to any conflict with other commitments, friends or family?

There are comments about these questions below.

Have you enjoyed your study?

Ideally you will have enjoyed most of it. If you haven't, you could think about making some changes to the way you are working. You may be familiar with the material in the *Preparatory Resource Books* and this may make it seem repetitive. Why not check that you can do the 'Try these first' questions and that you are familiar with the outcomes for each module? Then move on to the next stage.

You may be trying to work under too much pressure, or feel a lack of progress. You may have to find some more time so that you can study the material more slowly.

As you are working on your own, you are unable to compare your progress with that of others. When MU120 begins, you will be able to obtain help from your tutor; you may also have the opportunity to meet other students at tutorials and be able to share any problems and help each other. You will find further comments about sources of help in Section 13.5 of this book.

Did your concentration wane at all?

Most students would probably answer 'Yes' to this question! However, did it happen to such an extent that it seriously hindered your progress? Again, the reason here might be lack of sufficient challenge from the *Preparatory Resource Books*.

You may be trying to work for too long at any one time. Learning is a time-consuming process and it takes time for anyone to assimilate ideas. After a certain time (about two hours for many people), further study is not very productive. You might need to break your concentration, at least for a few minutes, after a relatively short period of study. If you recognize that you are not getting anywhere, perhaps you could stop working for a while and do something else.

Another reason might be distractions. Were you perhaps too comfortable? Was there something that you would rather be doing or should be doing?

Might study be easier at another time of day, when you feel fresher, or in another place?

Did the work take longer than you had expected?

Your estimates of study time may have been unrealistic and you may have to accept this and plan your work schedule accordingly. If you study using a large number of short periods, you need time to pick up the threads of work each time. You may prefer to continue to work in this way, but allow extra sessions, or you might try some longer periods of study.

Are you being too thorough or making too many notes? If you find yourself spending much longer than you expected, perhaps you are expecting to understand too much on first reading. If you do not fully understand something, rather than rereading it, try some questions or examples. Your understanding is likely to grow as you work through them.

Can you remember what you have read?

You might find it hard to remember because you have not studied for a while (perhaps a long while!). It is natural for it to take some time before your mind gets used to working in this way, so don't worry. Many students find this a problem in the early stages, but it gets easier.

If you find it hard to remember the material you have studied, it can be worth reviewing previous sections before continuing. If you are studying new topics, you may understand them when you first read them, but they can be hard to remember later. Most topics in MU120 will be used again in later work and this repetition should help you to remember and use the most important mathematical ideas. You might consider putting more effort into note taking. Many students find that the actual note taking itself helps them remember material later. You might also try making a fuller set of notes (but not writing out the whole section!) at one reading, then condensing them to a smaller set, illustrating only the main points, and filing them for future reference.

Do your notes help you to recall what you have read?

The secret of good note taking is to achieve a good balance, including all the important results but not too much detail. Many students find it hard to decide which is which, and where to lay their emphasis. You could consider including less material or use larger paper or more colours. Similarly, if you are annotating your texts as described in Section 4.2, are you picking out too much or too little, or would more colours help? You can annotate your responses to questions and activities too.

Has your study so far led to any conflict with other commitments, friends or family?

It is difficult to advise you about conflict caused by study, but you may need to reconsider what you have given up, or could give up, to make time for your study. You may need to talk about this, or even negotiate it, but you will need to set your own priorities. If some conflict is unresolved, it is most important that you should do what you can to improve things as quickly as possible. In particular, family or friends may not appreciate your need to be undisturbed while you are studying, but it is worth sorting this out sooner rather than later.

Hopefully, you are now establishing some sort of study pattern. You may have found that it was a good strategy for you to tackle the sections separately, not moving on to a new section until you were totally happy with the one before. In practice, though, you may find that time is against you and that you cannot afford much time for mulling over a section before starting work on the next.



In the next section, you will have the opportunity to test your recall by trying some short multiple choice questions in the computer-marked assignment (CMA) on Modules 1, 2, 3, and 4.

Activity 26 How am I doing?

Check that you have achieved the following outcomes and, if not, look back at the relevant parts of the section or module, and make plans on how you might achieve them.

Outcomes

Now that you have completed your study of this section, you should be able to:

- ◇ start to monitor and assess your own progress in studying;
- ◇ reflect on your methods of studying and learning, continually improving and developing your strategy;
- ◇ explain what a percentage is and solve problems involving ratios, proportion and percentages.

7 Assessment: computer-marked assignments

Aims As you work through this section, you will be:

- ◇ tackling the type of multiple-choice questions used in computer-marked assignments;
- ◇ doing the Preparatory CMA, completing a CMA form and mailing it;
- ◇ using your feedback on the CMA to help with the rest of your preparation;
- ◇ checking your understanding of the following mathematical topics:
 - squares and square roots;
 - powers of ten and scientific notation.



Assessment and feedback are essential parts of learning. You need constructive feedback to enable you to change and improve for future work. During your study of this preparatory package you have been involved in self-assessment: for example, by checking the lists of outcomes at the end of each section. However, you have probably not received much, if any, external feedback on your performance. In this section, you will have an opportunity to complete an assignment and receive feedback on it. You will also see how you might use assignments for self-assessment before submitting them for marking, and the ways in which you can use the feedback when they are returned to you.

During your study of MU120, your understanding of the course material will be tested by means of *assignments* based on the units. There are two types of assignment: tutor-marked assignments (TMAs) and computer-marked assignments (CMAs). The former consist of long questions each of which may take an hour or more to answer, while the latter consist of shorter, multiple-choice questions. Your tutor will provide you with written comments and advice on the TMA when he or she marks it. Completing a CMA can help you assess your understanding of basic concepts and practise mathematical skills and techniques. When it has been marked you will receive a feedback letter giving you the answers, showing you which questions you answered correctly and giving your overall score. Assignments also provide a useful incentive for keeping up to date with the course—there are strict deadlines for their submission, so they help to ensure that you work steadily through the course.

Once the course starts, both TMAs and CMAs will count towards the award of your course credit at the end of the year, but their main purpose is to help you to check your understanding of the course material and give you feedback on your work.

You now have the opportunity to assess your mathematical work so far by doing a CMA. (There is also a TMA later.) The questions are similar in style to those of the computer-marked assignments in MU120.

There is more information about assignments in the *Student Handbook*.

However, the assignments associated with this preparatory package do not count towards your continuous assessment grade on MU120. You are invited to submit these assignments to check how you are progressing and to receive feedback on your understanding. Do submit the CMA, even if you are quite happy with your progress so far, in order to practise completing a CMA form and using feedback as part of your learning.

You will find the questions in the separate Preparatory Assignment Booklet, but it is better to finish your study of the mathematics in this section before you attempt the questions.

7.1 Revising powers of ten and scientific notation



Activity 27 Module 4

Implement your (revised) study strategies in your study of Module 4. First look at your comments on the 'Prep. to do' Activity Sheet and have a brief look at Module 4 to see which sections you need to study. Decide to what depth you need to study each one. Then plan your work on this module bearing in mind the need to include time for ideas to 'sink in'.

Now study Module 4.



Activity 28 Word power

Read the reader article 'Powers of ten', which is an extract from Vikram Seth's novel *A Suitable Boy*.

List all the powers of ten for which you know the names.

7.2 Doing a CMA

When answering computer-marked assignments, it is advisable to look quickly through the questions first in order to plan your time and decide which materials you will need for reference. (You may, of course, use your notes and the texts to help you answer the questions.) Then work through the questions, keeping your working so that you can check it and noting your answers, perhaps on the assignment booklet. Do not write on the CMA form until you have checked your answers.

Here are two sample CMA questions.

Example 1

The numerical information given in newspaper articles can be confusing because the numbers are often expressed as a mixture of fractions, decimals and percentages. This can make it difficult to compare the figures quoted.

Consider each of the following comparisons and decide which **two** are true.

- A $\frac{5}{8}$ is greater than 0.75
- B 70% is less than $\frac{5}{7}$
- C $0.66 = \frac{2}{3}$
- D 23% is greater than 0.25
- E $\frac{1}{2}$ is greater than or equal to $33\frac{1}{3}\%$
- F $\frac{3}{13}$ is greater than $\frac{4}{17}$

Example 2

It is thought that one of the Great Pyramids of Egypt contains some 2 million stone blocks. If each of these stone blocks weighs, on average, about 2500 kilograms, which one of the following would be reasonable as an estimate of the total mass of stone, in grams, used to build the pyramid?

- A 1.25×10^6
- B 1.25×10^9
- C 1.25×10^{12}
- D 5×10^{12}
- E 5×10^{10}
- F 5×10^9

Activity 29 Practising CMA questions

Try these sample questions now. These questions do not form part of the preparatory CMA so you should not write the answers on the CMA form; instead keep them so that you can check them later.

Comment on Example 1

In order to decide which are true you need to write both sides of the comparison in the same way.

- A** $\frac{5}{8} = 0.625$. So the statement that $\frac{5}{8}$ is greater than 0.75 is false.
- B** Expressing $\frac{5}{7}$ as a percentage gives $\frac{5}{7} \times 100 \simeq 71.4\%$. Consequently, the statement that 70% is less than $\frac{5}{7}$ is true.
- C** The calculator shows that $\frac{2}{3} = .666666667$. This is close, but not equal to, 0.66 so the statement that $0.66 = \frac{2}{3}$ is false.
- D** 23% as a decimal is 0.23. So the statement that 23% is greater than 0.25 is false.
- E** $33\frac{1}{3}\%$ as a fraction is $\frac{1}{3}$. Since $\frac{1}{2}$ is greater than $\frac{1}{3}$, the statement that $\frac{1}{2}$ is greater than or equal to $33\frac{1}{3}\%$ is true.
(Alternatively, $\frac{1}{2}$ is 50% and 50% is greater than $33\frac{1}{3}\%$.)
- F** $\frac{3}{13} \simeq 0.231$ and $\frac{4}{17} \simeq 0.235$, thus $\frac{3}{13}$ is greater than $\frac{4}{17}$ is false.
(Alternatively, $\frac{3}{13} = \frac{51}{13 \times 17}$ and $\frac{4}{17} = \frac{52}{13 \times 17}$.)

So B and E are true.

You can check your answers to this type of question by using your calculator to subtract the number that is claimed to be smaller from the number that is claimed to be larger. If the answer is positive, then the 'greater than' statement is true; if the answer is zero, then the two numbers are equal; if the answer is negative, then the statement is false.

Comment on Example 2

First, express all the numbers in scientific notation:

$$2 \text{ million} = 2 \times 10^6$$

$$2500 = 2.5 \times 10^3$$

$$1 \text{ kg} = 1000 \text{ g} = 10^3 \text{ g}$$

So, the total mass of stone, in grams, is about

$$\begin{aligned} 2 \times 10^6 \times 2.5 \times 10^3 \times 10^3 &= 5 \times 10^6 \times 10^3 \times 10^3 \\ &= 5 \times 10^{12} \end{aligned}$$

So answer D is correct.

Activity 30 Trying the CMA questions

Try the questions on the preparatory CMA now (but do not write on the CMA form yet).

You should try to answer all of the questions before you send in the assignment, but if there are some questions about which you are unsure you can leave them; the feedback letter will explain them to you. However, if you are unhappy about many of the questions, you may need to reconsider your study technique or seek help.

The sign $\simeq$ means 'approximately equal to'.

Remember to *add* the powers of 10.



7.3 Filling in the CMA form

Once you have decided on your answers, you need to transfer them to a computer-marked assignment form (CMA form). The assignment number, your personal OU identifier (this is the number that appears on all OU correspondence to you) and your choices of answers to the questions need to be marked in cells on the form by drawing horizontal lines across the cells with a lead pencil. You should use an 'average' or HB-grade pencil to mark the form: this sort of pencil leaves a mark which can be distinguished by the document reader when your assignment is marked. There is a CMA form in this preparatory package, and instructions on its completion are given in the Preparatory Assignment Booklet.

Activity 31 Form filling

Look at the instructions for completing the CMA form in your Preparatory Assignment Booklet.

Fill in Part 1 of the CMA form, then transfer your answers to the cells in Part 2 of the form.



You will see that as well as options A to H there are two additional columns within the CMA form: '?' and 'U'. If you do not know the answer to a particular question, rather than guessing, fill in the '?' cell. However, if you think that the question itself is unsound (that is, it cannot be answered or there is no option corresponding to the answer), then you should indicate this by picking the 'U' cell as well as another answer or the '?'.

You *must* respond to each question with a letter (or letters) or '?'. Use the 'U' cell *as well* if you think that the question may be in error. This will cause the University to check the question and it may be ignored for assessment purposes if there is indeed an error in the question.

You should now be ready to send off your computer-marked assignment, but first just check that you have transferred your answers correctly. Then fold the form inwards along the central dotted line and post it in the envelope provided. You are advised to send the form by first-class post and to obtain proof of posting. You should receive your feedback letter within ten days.

While you wait for your feedback letter, consider what you should do next. If you feel that you had trouble with any of the questions, which were based on the materials you have studied so far, then maybe you should take time now to read more from the *Preparatory Resource Books*. Think about how you might improve your method of study to get over any difficulties.

Activity 32 *Revising your study methods*

Consider the way you worked to complete the CMA; are you happy with all aspects of your method of study? If not, it is worth trying to sort out doubts now, before you start the course.

There are various ways of tackling a CMA. One extreme is to look for similar examples in the *Preparatory Resource Books* and copy the method, just changing the numbers. This may lead to an encouraging response from the computer but it does not help you to learn mathematics or to judge your progress. The opposite extreme is to send off only those answers that you can produce without reference to the text and this is equally inadvisable.

However, there is a lot to be gained from a mixture of these extreme approaches. When you come to work on the other assignments, you might like to tackle them like this.

- 1 Look through all of the questions and sort out those that you think you can do immediately and those that you cannot.
- 2 Study your notes and/or the material in the text relevant to those questions you could not tackle immediately.
- 3 Try all the questions, without using the text, and note those you still cannot do. When attempting a question similar to Example 2, work it through to an answer, before looking at the options. If there is no option corresponding to your answer, rework that question.
- 4 Go back to the text for help with questions which you've left out and for reassurance about any answers you're dubious about.
- 5 Annotate or supplement your notes to cover any gaps.
- 6 Make a note of problem areas and come back to them in week or so to see whether you did solve the problem!

Activity 33 *Topic check*

Go back over the assignment now and make a list of those topics which you feel you should return to later to check your understanding. Amend your study plans as necessary, in particular your study timetable (Activity 6).

The remainder of this section should be read after you receive your feedback letter. If you want to carry on working now, make a start on Section 8 and come back to this section after you have received your letter.

7.4 Receiving your feedback letter

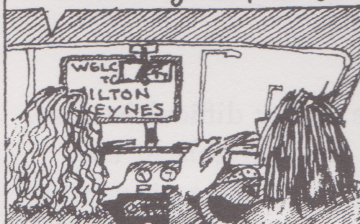
When you receive your feedback letter, naturally the first thing you will look at is the overall result. Were you satisfied with your performance? If not, there may be some areas of misunderstanding. Checking through a marked assignment is a very important part of the learning process. Through reading comments on your work, you may discover misconceptions and errors of which you were unaware at the time you sent the work in.

Activity 34 Using feedback

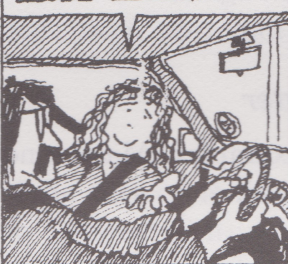
Check through the assignment again, picking out questions which you answered incorrectly. You can ignore simple arithmetical errors—unless the message is that you make too many! If necessary, add to your list of topics to revisit before the start of the course and make any necessary amendments to your study plans.

YOU ARE AWFUL

I think it's a really good idea having an Open Day.



It's an opportunity to put faces to all those names ...

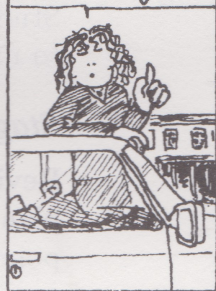


...update the haircuts from the TV programmes

...and the fashions, beh beh



...meet one's personal gurus...



...I'm particularly looking forward to meeting the computer that marks my CMAs!



Finally, check that you have achieved the outcomes for this section and, if not, make plans to do so.

Outcomes

Now that you have completed your study of this section, you should have:

- ◇ completed the preparatory CMA;
- ◇ used the feedback from your CMA.

You should also be able to:

- ◇ use and explain the meaning of squares, square roots and scientific notation.

8 Consolidating study skills



Aims As you work through this section, you will be:

- ◇ reviewing the study skills introduced so far;
- ◇ consolidating these study skills;
- ◇ checking your understanding of the following mathematical topics:
diagrams, tables, charts and graphs.

Here is one student's method of studying. How does it compare with your own? Which aspects might be useful to you?

Stage 1

Look through the module or unit: decide on its main themes and how its subsections fit together. Summarize this in diagrammatic or word form. Add an estimate of study time.

Stage 2

Study a section, working through the activities, making notes and trying to master techniques. This may take more than one session.

Stage 3—a day or two later

Review notes and worked examples. Make a note of any difficulties and plan to do any additional work or to seek advice later. Highlight key points in the text and notes with fluorescent pens or in some other way.

Stage 4

Repeat stage 2 and 3 with another section until the module or unit is complete.

Stage 5

Assess understanding by:

- ◇ checking the list of unit or module outcomes;
- ◇ listing or drawing a diagram to include all key points and how they link together;
- ◇ trying a random selection of questions from the module or unit.

Activity 35 Module 5

Now work through those parts of Module 5 in *Preparatory Resource Book B* that you have decided to study, using the above method or your own preferred one.

Finally, check that you have achieved the outcomes below and, if not, make plans to do so.

Outcomes

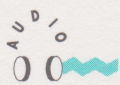
Now that you have completed your study of this section, you should have:

- ◇ reviewed your method of studying a module.

You should also be able to:

- ◇ read information from diagrams, tables, charts, and graphs, which you might encounter in the media.

9 Communicating mathematics



Aims As you work through this section, you will be:

- ◇ improving your mathematical communication, both in speech and in writing;
- ◇ improving your skills in learning from audiotape;
- ◇ checking your understanding of mathematical language, notation and formulas.

You should make every effort to study the material covered by the audiotape band for this section, irrespective of your previous mathematical background.

An integral part of learning mathematics involves communication. Think of the different forms of communication you have already used during your study of this preparatory package. You have been asked to read and respond to text material, listen to audiotape bands, use diagrams and write out responses to questions. You may also have spoken with your tutor or discussed some of the work with members of your family or friends.

All through your study of MU120, you will be writing solutions to assignment questions and these will be marked by your tutor. Writing mathematics is a specific skill which needs to be developed and practised: there is a lot of difference between putting down a few symbols for your own use and writing a mathematical solution intended for someone else to read. In attempting the questions in the *Preparatory Resource Books*, you may have written down very little, just enough, perhaps, to convince yourself that you could answer the questions. This may suffice now, but it is not what your tutor will expect in response to assignment questions. Your tutor will hope to receive solutions which are clearly set out and easily understood. Moreover, months after they were written, you may want to use your notes and solutions for revision so you too will want them to be self-contained, able to stand on their own and easy to read.

9.1 Writing mathematics

How do you write mathematics which can be read and understood easily by anyone else, such as your tutor or another student?

It takes practice, but the following guidelines may be helpful.

- ◇ Ensure that what you write consists of sentences. Too many people believe that mathematics is a language which is entirely made up of unfamiliar symbols. It is not. Many symbols act in part merely as abbreviations which, when read, can be translated back into spoken words.
- ◇ Ensure that there are sufficient words of explanation so that the reader is led, line by line, through your proposed solution or argument.



One way of testing whether or not you are conforming to the first guideline, is to read your solutions through aloud. Speaking aloud involves you in translating every symbol on the page into its verbal equivalent. If you find yourself needing to say more than is written on the page, you may need to expand your written account. To give you practice at this and at assessing the quality of some written mathematics, you should work through the audiotape band. The actual mathematics used is not important; just concentrate on the style of its presentation.

Working through the next band of the audiotape should take you about forty minutes. The relevant frames are printed on the following pages.

There is also an Activity Sheet called 'Communicating mathematically' which you may find helpful to complete as you listen to the tape.

Now listen to band 3 of the Preparatory Audiotape.



Frame 1

Difference
between 9
and 24

Product

Odd

Draw rings around the odd numbers:

2

-3

16.755

1

41

$5\frac{1}{3}$

42

Complete the sentence:

An odd number is _____

Frame 2

Again, complete the sentence:

An odd number is: _____

this time phrasing your answer as if to a non-mathematical friend.

Frame 3

Spelling	Written form	Reading
c-a-l-c-u-l-a-t-e	calculate	calculate
two over three	$\frac{2}{3}$	two-thirds
three-four-two-seven-six-one-nine	3427619	

Frame 4

Some Greek letters

Lower-case letter	Said
α	alpha
β	beta
π	pi

Frame 5

Symbol	Read as
$\times$	
$=$	
$\%$	
$\sqrt{\quad}$	
$-$	

Frame 6

$3 - 2$ operator 'minus' or 'subtract' three minus two

$-2 + 3$ sign of number: 'negative' negative two plus three

Frame 7

Read the following calculations aloud:

(a) $\frac{3 \times -5}{2(7 + 8)} = \frac{-1}{2}$

(b) $\sqrt{(4 + 5)} = 3$

Write the following in symbols and then carry out the calculation:

Divide 3 by negative 4, giving your answer as a decimal.

Frame 7a

$$\frac{3}{-4} = -0.75$$

Frame 8

Suppose you see that a favourite shop of yours has a sale offering 25% off everything. What would be the sale price of an article, if it had previously cost £15.99?

Frame 9

One 'solution'—not recommended

$$\text{Price} = 15.99 = 25\% = 25/100 \times 15.99$$

$$= 3.9975 = 15.99 - 3.9975 = 11.9925$$

Frame 10

Another solution

Old price is £15.99

The reduction is 25%, so the new price is 75% of the old price, i.e.

$$\text{New price is } \frac{75}{100} \times 15.99 \text{ pounds} = 11.9925 \text{ (pounds).}$$

So the new price is £11.99 (rounded to the nearest penny).

To conclude this section, work on Module 6 in *Preparatory Resource Book B*. When you answer the mathematical questions, try to set down your answers so they are clear and easy to follow by someone (such as your tutor) who is 'reading' them.

Activity 36 Module 6

Decide which parts of Module 6 you need to study and then work through them. Try to write 'good' answers to the questions.

Make a list of topics for further attention from this and previous modules. Amend your study plans as necessary.

Try out your ability to communicate mathematics in the next section, when you complete a written assignment to send to your tutor.

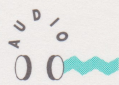
Outcomes

Now that you have completed your study of this section, you should be able to:

- ◇ write clear, unambiguous mathematical solutions using appropriate notation;
- ◇ identify and modify some sources of ambiguity or inappropriate use of notation in a mathematical solution;
- ◇ use word formulas to calculate given quantities.



10 Writing solutions to tutor-marked assignments



Aims As you work through this section, you will be:

- ◇ consolidating your learning so far from this text, from the *Preparatory Resource Books* and from the *Calculator Book*;
- ◇ tackling a tutor-marked assignment (TMA) and sending it to your tutor;
- ◇ using the feedback from your tutor to improve your mathematical understanding and communication skills;
- ◇ checking your understanding of the following mathematical topics:
shapes, areas, volumes and angles.

This section contains a discussion of the precise meanings attached to words like 'find', 'show', 'write down' and 'determine' in mathematics questions. You should read this section thoroughly: it is important that you know how these words are used in MU120.

One of the ways your performance on the course will be assessed will be through your solutions to the TMAs. This section also offers advice on the preparation of an assignment for your tutor. In particular, you will look at the format of questions, writing out solutions and mailing them to your tutor.

10.1 Completing the Preparatory Resource Books

Before you can tackle the TMA you need to complete your study of the *Preparatory Resource Book B*, by studying Module 7. Look back at your solutions to Section 7 of the Diagnostic Quiz and at your comments on your answers; think about your understanding of the solutions in the Diagnostic Quiz Solutions. Use this information to decide upon your study strategy for the module.



Activity 37 *The final module!*

Decide which sections of Module 7 you need to study. Work through the questions, trying to make your answers as clear and unambiguous as possible, paying attention to using accurate notation.

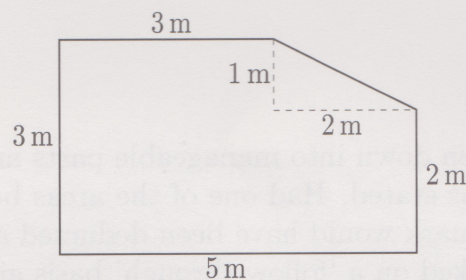
If you still have outstanding topics from earlier modules, complete your study of these as well.

10.2 The format of TMA questions

Before you can attempt an assignment, you must read and understand the questions. This may sound obvious but you will need to know, before you start, what is expected by way of an answer. In particular, you will need to know the meaning of the instructions contained in the question. In this section the different types of instruction are illustrated by posing several questions all based on the same initial problem.

Example 3

Suppose you plan to redecorate your bathroom. The end wall has the following shape, with dimensions as shown on the diagram. The quality of the plasterwork is not good and you are considering tiling the wall.



Write down the area of this wall.

[4]

The number [4] at the right-hand side means there are four marks awarded for a correct solution. All TMA questions in MU120 will state how many marks are allocated to each question or part of a question. The marks give an indication of the length of answer expected. For example, if a question is in two parts, the first of which is allocated two marks and the second eight marks, then you would expect the first part to have a shorter and more straightforward solution than the second. Here, four marks would be awarded for stating the answer correctly, as in the solution below, because all you were asked to do was to 'write down' the area.

Solution A to Example 3

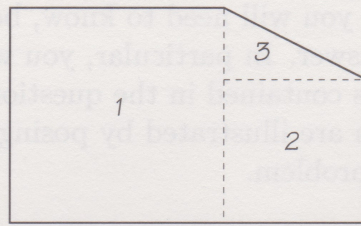
$$\text{Area} = 14 \text{ m}^2 \quad \checkmark \quad 4/4$$

Comment

This solution does get full marks, but if 14 had been the wrong value the mark would have been zero. It is therefore a good idea to show working *even when it is not required*; some marks can be awarded for a wrong answer if there is an indication of a correct method being used.

Solution B to Example 3

The area of the wall can be divided into 3 parts as shown below.



The area of square 1 is $3\text{ m} \times 3\text{ m} = 9\text{ m}^2$ ✓

The area of square 2 is $2\text{ m} \times 2\text{ m} = 4\text{ m}^2$ ✓

The area of triangle 3 is $\frac{1}{2} \times 1\text{ m} \times 2\text{ m} = 1\text{ m}^2$ ✓

The total area is $9\text{ m}^2 + 4\text{ m}^2 + 1\text{ m}^2 = 14\text{ m}^2$ ✓ **Total mark $\frac{4}{4}$**

Comment

Here the area is broken down into manageable parts and each area is found before the total area is stated. Had one of the areas been wrongly calculated, only one mark would have been deducted and the remainder would have been marked on a 'follow through' basis giving almost full marks when a small error has been made.

When asked to 'write down' a solution, try to judge how much working to give by looking at the number of marks available for a correct solution.

'Follow through' means that credit is given for the method, even though the wrong value has been used.

Example 4

Suppose you have decided to tile the wall using square tiles of side 10 cm. You are proposing to use the tiles across the full width of the wall up to a height of 1.8 m.

Find the number of boxes of tiles that you will require if the tiles are sold in boxes of twenty-five. [4]

The word 'find' implies some reasoning is required. Although the following solution contains an error (so it does not get full marks), it is nevertheless worthy of credit. Note how marks are awarded for correct reasoning and justification.

Solution A to Example 4

Width is 5 m = 500 cm so $\frac{500}{10} = 50$ tiles are needed ✓ $\frac{1}{1}$

Height is 2 m = 200 cm so $\frac{200}{10} = 20$ tiles are needed ✓ $\frac{0}{1}$

Number of tiles needed is $50 \times 20 = 1000$ ✓ $\frac{1}{1}$ F.T.

Number of boxes is $1000/25 = 40$ ✓ $\frac{1}{1}$ F.T.

Total mark $\frac{3}{4}$

Can you spot the error?

(F.T. means follow through—that is, accurate working since the error.)

Comment

The error occurs in line 2 where the height of the tiles has been taken as 2 m not 1.8 m. However, credit is gained for those parts that are correct, including correct work following the error.

Solution B to Example 4

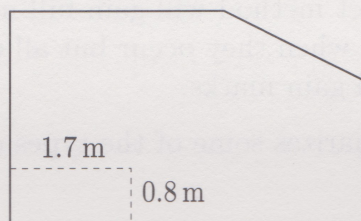
Number of boxes is 36 ✓ Total mark $\frac{1}{4}$

Comment

By contrast this correct answer gets only the single final mark—the reasoning and justification marks are forfeited.

Example 5

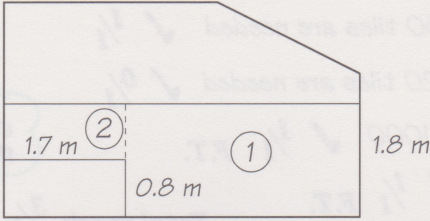
Suppose you now decide to place your new bath (length 1.7 m, height 0.8 m) against this wall as shown in the diagram below.



Given that you still intend to have the tiles to a height of 1.8 m, this means that you will not need so many tiles now. If a box of twenty-five tiles costs £14.75, show that the cost of tiling this wall will be £457.25. [7]

In this type of question you are given the answer! All the marks are allocated for correct reasoning and justification. No marks are allocated for the final cost. Note how this is reflected in the way the marks have been awarded in the following solution.

Solution to Example 5



Area (1) = 1.8 m by (5 - 1.7)m
= 1.8 m by 3.3 m ✓

No. of tiles needed = 18 × 33
= 594 ✓

Area (2) = 1.7 m by (1.8 - 0.8)m
= 1.7 m by 1.0 m ✓

No. of tiles needed = 17 × 10
= 170 ✓

Total number of tiles needed = 594 + 170
= 764 ✓ $\frac{1}{1}$

Number of boxes needed = 764/25
= 30.56 ✓ $\frac{1}{1}$

So 31 boxes of tiles are needed ✓

Thus the cost of the tiles will be 31 × £14.75 = £457.25 ✓ $\frac{1}{1}$

Total marks $\frac{7}{7}$

Comment

This is one of at least three possible ways of showing that the cost will be £457.25. Any other correct method will gain full marks. As before, any errors would be penalized when they occur but all other correct work (even if it follows the error) will gain marks.

The following table summarizes some of the types of instructions you will encounter.

Write down ... What is ...	Determine ... Find ... Calculate ...	Show ...
A simple answer will do but generally give some working.	Justification for your answer is required. This will be reflected in the marks.	The answer is given to you. All marks awarded for a convincing argument.

10.3 Approaches to problem solving

This section considers approaches to tackling the mathematical questions and problems you will meet in MU120. You should not expect always to be able to read a problem and then just write down the answer; this is rarely, if ever, possible. When you are faced with a written question or problem to solve, you should make sure that you read it carefully. It is important that you get to grips with the question in two ways: first, that you absorb the information given; and second, that you find out what the question is really asking. Your solution will link the two. This method can be summarized by the following questions.

What do I *know*?

What do I *want*?

In order to get to grips with what a question is really about, it can often be helpful to begin by drawing a diagram.

It is very important not to rush into trying to solve the problem. Try to decide not only what you *know* from the question itself, but also what you *know* from past experience which is at all relevant to the problem.

When you consider what you *want*, first decide whether you have to (a) find an answer or (b) show that something is true. If you do not take time to do this, you may end up not really answering the question—you may even get unnecessarily stuck!



When you reach an answer, or you are about to give up because you are stuck, it may help to *review* your work. Try to write out your thoughts as clearly as possible so that you can easily see each step and the ideas they are based on.

Always consider whether the answer you have come up with 'makes sense'; that is, step back a bit and see whether it fits in with the other information that you have.

If you are stuck you may need to leave the problem for a while and then come back to it, in order to see it more clearly. In this case, it is vital that you have written down what you have done so far.

If you cannot make any progress with the problem, then it is a good idea to talk to someone about it. This might be your tutor, but could also be a fellow student or even a friend. The act of describing a problem to someone can often be enough to help you see what you should do to arrive

at a solution. If there is nobody to talk to, try verbalizing the problem aloud—‘talking to yourself’ can be really helpful.

10.4 Writing out solutions

Before you tackle the preparatory TMA, it is worth practising writing solutions to some questions (contained in the following activities) just as if they formed part of a TMA. Then think about how they would be marked.

The tutor’s task is two-fold: not only to grade the solution but also to supply comments to clarify ideas which you may have misinterpreted or not fully understood, to correct mathematical errors and to suggest ways whereby style of presentation can be improved. The comments made on assignments are an important and integral part of learning with the Open University: study these comments soon after your assignments come back.

To give yourself some practice at reading comments, read and criticize the following sample solutions and then read what the tutor wrote about them. See if any of the tutor’s comments are applicable to your own solutions.

Activity 38 Your solution

Write out a full solution to the following problem.

You may think that you know what the word *billion* means but do you really have a feel for its size?

- (a) Write down one billion as a power of 10. [3]
- (b) Consider how far a billion centimetres (cm) is. Determine what one billion cm is in kilometres (km). How does it compare with the distance between Saturn and the Sun, which is 1 427 000 000 km? [5]
- (c) Now consider one billion seconds. Determine how long this is approximately in years (round your answer to the nearest whole number). [7]
- (d) Finally, if there are 4 980 000 grains in 1 kilogram (kg) of sugar, show that one billion grains of sugar are approximately equivalent to 2×10^2 kg of sugar. [5]

Activity 39 Looking at others’ solutions

Comment on each of the sample solutions below. You should consider both mathematical accuracy and style. Then compare your comments with those on the marked solutions.

Sample Solution A to Activity 38

(a) 1 billion = 1 thousand $\times$ 1 million = $10^3 \times 10^6 = 10^9$

(b) 1 billion cm = 10^9 cm = $10^9 \times \frac{1}{100}$ m = 10^7 m = $\frac{10^7}{1000}$ km = 10^4 km

Saturn to the Sun is 1427000000 km = 1.427×10^9 km

This is well over one billion kilometres (10^9 km),
so it is much greater than one billion centimetres (10^4 km).

(c) 10^9 s = $\frac{10^9}{60}$ minutes = $\frac{10^9}{60 \times 60}$ hours = $\frac{10^9}{60 \times 60 \times 24}$ days
= $\frac{10^9}{60 \times 60 \times 24 \times 365}$ years ≈ 31.7 years

(d) 1 kg sugar = 4980000 grains

10^9 grains = 4980000×10^9 kg sugar
= 4.98×10^{15} kg sugar

Tutor's comments on Sample Solution A

(a) 1 billion = 1 thousand $\times$ 1 million = $10^3 \times 10^6 = 10^9$ ✓ $\frac{3}{3}$

(b) 1 billion cm = 10^9 cm = $10^9 \times \frac{1}{100}$ m = 10^7 m = $\frac{10^7}{1000}$ km = 10^4 km ✓

Saturn to the Sun is 1427000000 km = 1.427×10^9 km

This is well over one billion kilometres (10^9 km),
so it is much greater than one billion centimetres (10^4 km). ✓ $\frac{5}{5}$ Good

(c) 10^9 s = $\frac{10^9}{60}$ minutes = $\frac{10^9}{60 \times 60}$ hours = $\frac{10^9}{60 \times 60 \times 24}$ days
= $\frac{10^9}{60 \times 60 \times 24 \times 365}$ years ≈ 31.7 years = **32 years (to the nearest whole number)**

(d) 1 kg sugar = 4980000 grains **Yes**

10^9 grains = 4980000×10^9 kg sugar **No** $\frac{0}{5}$
= 4.98×10^{15} kg sugar

A common error —
it may help you to put
in extra steps, like this:

4980000 grains weigh 1 kg

1 grain weighs $\frac{1}{4980000}$ kg

10^9 grains weigh $\frac{10^9}{4980000}$ kg ≈ 200 kg = 2×10^2 kg

**Didn't this seem
rather large?**

$\frac{14}{20}$ Good

Sample Solution B to Activity 38

- (a) 10^9
 (b) $10^9 \div 10^2 \div 10^3 = 10^4$
 (c) $10^9 \div 60 \div 60 \div 365 = 761$
 (d) $\frac{4980\,000}{10^9} = 4.980 \times 10^6 \div 10^9 = 4.980 \times 10^{-3}$

Tutor's comments on Sample Solution B

- (a) 10^9 ✓ $\frac{3}{3}$ Good
 (b) $10^9 \div 10^2 \div 10^3 = 10^4$ ✓ $\frac{2}{5}$ Good — but you missed out Saturn!
 * see note 1 below You forgot about hours in a day —
 (c) $10^9 \div 60 \div 60 \div 365 = 761$ $\frac{5}{7}$ do one step at a time.
 (d) $\frac{4980\,000}{10^9} = 4.980 \times 10^6 \div 10^9 = 4.980 \times 10^{-3}$ $\frac{0}{5}$

You have them the wrong way up — see note 2 below.

BUT you should have realized that this answer was ridiculously small and so something was wrong.

Note 1

You don't need to worry when you multiply —

$10^9 \times (10^2 \times 10^3)$ is the same as $(10^9 \times 10^2) \times 10^3$ but you must watch the order when you divide —

$10^9 \div (10^2 \div 10^3)$ is not the same as $(10^9 \div 10^2) \div 10^3$

$$\begin{array}{c} 10^9 \div (10^{-1}) \\ \downarrow \\ 10^{10} \end{array}$$

$$\begin{array}{c} 10^7 \div 10^3 \\ \downarrow \\ 10^4 \end{array}$$

It's safer to put in intermediate steps.

Note 2

You would be better saying what you are doing and using intermediate steps.

4980 000 grains weigh 1 kg

1 grain weighs $\frac{1}{4980000}$ kg

10^9 grains weigh $\frac{10^9}{4980000}$ kg ≈ 200 kg $= 2 \times 10^2$ kg

$\frac{10}{20}$ A pity — you are capable of doing so much better — slow down, read the question, explain what you are doing.

Activity 40 St Ives

Write out your own solution to the following problem. Then comment on the sample solutions which follow as if you were the tutor. Finally, use the tutor's comments to assess your own solution and comments.

As I was going to St Ives
 I met a man with seven wives.
 Each wife had seven sacks,
 Each sack had seven cats,
 Each cat had seven kits.
 Kits, cats, sacks and wives
 How many were going to St Ives?

- (a) Write down the *people* I met. [2]
 (b) Find the number of wives, sacks, cats and kits. [4]
 (c) Show that the number of kits is 7^4 . [4]
 (d) What is the answer to the riddle? [2]

Sample Solution A to Activity 40

(a) I met the man, his wives, their sacks, their cats and their kits.

(b) There were seven wives (given in the question).

Each wife had seven sacks: there were 7×7 or 49 sacks

Each sack had seven cats: there were 49×7 or 343 cats

Each cat had seven kits: there were 343×7 or 2401 kits

$$\begin{aligned} (c) \quad 7^4 &= 7 \times 7 \times 7 \times 7 \\ &= 49 \times 49 \\ &= 2401 \end{aligned}$$

so there were 7^4 kits.

$$\begin{array}{r} 49 \\ \times 49 \\ \hline 441 \\ 1960 \\ \hline 2401 \end{array}$$

(d) There was 1 man
 7 wives
 49 sacks
 343 cats
 2401 kits
 2801 all together

So there were 2801 going to St Ives

Tutor's comments on Sample Solution A

- question said 'people'**
- (a) I met the man, his wives their sacks, their cats and their kits. $\frac{1}{2}$
- (b) There were seven wives (given in the question). ✓
 Each wife had seven sacks: there were 7×7 or 49 sacks ✓
 Each sack had seven cats: there were 49×7 or 343 cats ✓
 Each cat had seven kits: there were 343×7 or 2401 kits ✓ $\frac{4}{4}$

(c) $7^4 = 7 \times 7 \times 7 \times 7$
 $= 49 \times 49$
 $= 2401$
 so there were 7^4 kits. ✓

$$\begin{array}{r} 49 \\ \times 49 \\ \hline 441 \\ 1960 \\ \hline 2401 \end{array}$$

This is correct but a long way round. If you had left the 7s in above, it would have been simpler.

- (d) There was 1 man
 7 wives
 49 sacks
 343 cats
 2401 kits
 2801 all together

✓ $\frac{4}{4}$

10/12 good

So there were 2801 going to St Ives $\frac{1}{2}$

Were they going to or coming from St Ives?

The rhyme is ambiguous.

The answer is either $2801 + 1$ (me) = 2802 or just 1.

Sample Solution B to Activity 40

- (a) I met the man and his wives
- (b)
- | | | |
|--------------------------------|-------|---------|
| 1 | man | (7^0) |
| 7 | wives | (7^1) |
| 7×7 | sacks | (7^2) |
| $7 \times 7 \times 7$ | cats | (7^3) |
| $7 \times 7 \times 7 \times 7$ | kits | (7^4) |

(c) $1 + 7 + 7^2 + 7^3 + 7^4 = 2801$ plus me
 $= 2802$

or 1 if they were going in the opposite direction.

Tutor's comments on Sample Solution B

(a) *I met the man and his wives* ✓ $\frac{2}{2}$

Number		Power of 7
1	man	(7^0)
7	wives	(7^1) ✓
7×7	sacks	(7^2) ✓ $\frac{4}{4}$
$7 \times 7 \times 7$	cats	(7^3) ✓
$7 \times 7 \times 7 \times 7$	kits	(7^4) ✓

(d) ~~(c)~~ $1 + 7 + 7^2 + 7^3 + 7^4 = 2801$ plus me
 $= 2802$ explain separately
 or 1 if they were going in the opposite direction. ✓ $\frac{2}{2}$

Good, but a table would be clearer

Right answer to part (c) but you haven't really 'shown' this — see below $\frac{1}{4}$

'Show' means produce a foolproof argument, e.g.

$$\begin{aligned}
 \text{Number of kits} &= 7 \times (\text{number of cats}) \\
 &= 7 \times 7 \times (\text{number of sacks}) \\
 &= 7 \times 7 \times 7 \times (\text{number of wives}) \\
 &= 7 \times 7 \times 7 \times 7 = 7^4
 \end{aligned}$$

$\frac{9}{12}$ good

Notice that the tutor suggests a clearer way of displaying the results. Also notice that the student lost marks for not really 'showing' that there were 7^4 kits, even though he or she probably understood this; the marks are for giving good, convincing reasoning.

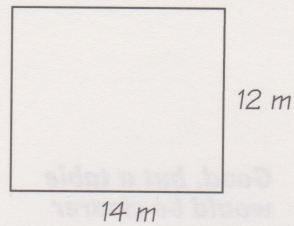
Activity 41 Making a lawn

Try the following question yourself. Then look at the sample solutions and mark them as if you were the tutor. Finally, use the tutor's comments to assess your own solution and comments.

Suppose you have some friends who are planning to put a new lawn in their garden. The lawn is to be 12 m by 14 m and they have a choice of either laying turf or sowing grass seed. You have been asked to help them decide between the two.

- Write down the area of the lawn. [3]
- The turf they can lay is sold in pieces, each of which is a square of grass measuring $\frac{1}{2}$ m by $\frac{1}{2}$ m. How many pieces of turf are needed to cover the lawn? [4]
- If a piece of turf costs 50p, write down how much it will cost to turf the lawn. [3]
- Grass seed is sold in boxes. Each box contains enough seed for 10 m^2 , and costs £5.15. Find the cost of sowing seed. [5]
- Which method is cheaper? Why might your friends choose the more expensive method? [3]

Sample Solution A to Activity 41



(a) Lawn area = $12 \times 14 \text{ m}^2 = 168 \text{ m}^2$

(b) Turf area = $\frac{1}{2} \times \frac{1}{2} \text{ m}^2 = \frac{1}{4} \text{ m}^2$

They need 4 pieces of turf to cover 1 m^2

They need 4×168 pieces of turf to cover 168 m^2

This is 672 pieces

(c) 1 piece costs 50 p

672 pieces cost $672 \times 50 \text{ p} = 33600 \text{ p}$

This is £336.00

(d) 1 box of seed covers 10 m^2

16 boxes of seed cover 160 m^2 (not enough)

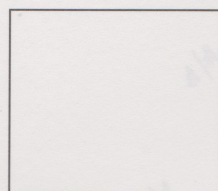
17 boxes of seed cover 170 m^2 (some to spare)

17 boxes are needed

1 box costs £5.15

17 boxes cost $17 \times £5.15 = £87.55$

(e) Grass seed is cheaper, but you have to wait while it grows. Turf gives an 'instant' lawn.

Tutor's comments on Sample Solution A

12 m

14 m

Yes, a good idea to draw a diagram.

(a) Lawn area = $12 \times 14 \text{ m}^2 = 168 \text{ m}^2$ ✓ $\frac{3}{3}$

(b) Turf area = $\frac{1}{2} \times \frac{1}{2} \text{ m}^2 = \frac{1}{4} \text{ m}^2$ ✓

They need 4 pieces of turf to cover 1 m^2

They need 4×168 pieces of turf to cover 168 m^2 **v. clearly explained** $\frac{4}{4}$

This is 672 pieces

(c) 1 piece costs 50 p

672 pieces cost $672 \times 50 \text{ p} = 33600 \text{ p}$ ✓ $\frac{3}{3}$

This is £336.00

(d) 1 box of seed covers 10 m^2

16 boxes of seed cover 160 m^2 (not enough)

17 boxes of seed cover 170 m^2 (some to spare) **Good sensible answer**

17 boxes are needed

1 box costs £5.15

17 boxes cost $17 \times £5.15 = £87.55$ ✓ $\frac{5}{5}$

(e) Grass seed is cheaper, but you have to wait while it grows. Turf gives an 'instant' lawn.

18/18**An excellent piece of work. Well done.****Sample Solution B to Activity 41**

(a) 168

(b) $4 \times 168 = 672$

(c) £336

(d) $\frac{168}{10} = 16.8 \times 5.15 = 86.52$

(e) Seed, don't know.

Tutor's comments on Sample Solution B

- (a) 168 m^2 ← don't forget the units $\frac{2}{3}$
 (b) $4 \times 168 = 672$ ✓ Correct — but risky not to show your working $\frac{4}{4}$
 (c) £336 ✓ $\frac{3}{3}$
 (d) $\frac{168}{10} = 16.8 \times 5.15 = 86.52$ Not quite — see my note (1) below $\frac{1}{5}$
 (e) Seed, don't know. ✓ See note (2) below $\frac{1}{3}$

Note (1) What you have written does not make sense — $\frac{168}{10}$ is NOT equal to 16.8×5.15

Write two separate lines and tell me what you are doing — I'm not a mind reader!

No. of boxes = $\frac{168}{10} = 16.8$

Cost of boxes (£) = $16.8 \times 5.15 = 86.52$

However, they may not sell 0.8 of a box — I expect you'll need 17.

Note (2) Seed takes time to grow into a lawn; with turf you get a lawn straight away.

11/18

From the sample marked scripts you can see that your tutor is likely to make some sort of comment even if you submit a near perfect solution. To help him or her, do please space out your work and leave enough room for comments. Also, it is best to write on A4 paper; this is the standard size used for nearly all Open University assessment documents.

You may now feel ready to start the preparatory TMA. Have a look through the questions and decide which you want to try first and which you intend to leave until after further study.

It is not, in general, advisable to tackle all the questions in a TMA in a single study session. In fact, once the course starts, you may want to do the question(s) on each unit immediately after studying that unit and then review the whole assignment once you have finished all the questions.



Activity 42 Preparing your TMA

Try as many questions on the preparatory TMA (in the Preparatory Assignment Booklet) as you feel ready to tackle, but do not send in your answers yet (even if you finish them all).

Remember the preparatory TMA does *not* count towards your course result, but your tutor's feedback will help you complete your preparation for MU120.

Activity 43 *With a tutor's eye*

Look over your solutions, as if you were the tutor, for lack of clarity or misuse of notation, and revise and improve your own solutions.

If you are studying this section well in advance of the start of the course, you may not have been allocated to a tutor yet. If this is the case you should carry on working through this book until you hear from the Regional Office who your tutor will be. If, on the other hand, you know your tutor's address you may wish to send the TMA to him or her. If the cut-off date is near you may do this, even if it is only partially complete and you will not have time to finish it. In either case, you should read the short subsection below on mailing your solutions when you are ready to send in the TMA.

Mailing your solutions: the TMA form

Once you have completed all the questions on a TMA, check the solutions, read them through and assemble them. Also make sure you have a copy of your work just in case it gets lost in the post—remember it is your responsibility to see that assignments arrive at your tutor's address by the required date. Remember also that, if you have written a large number of pages, you may need more than the basic rate of postage.

Before you post your solutions to your tutor you must attach a completed TMA form: instructions for completing it are in the Preparatory Assignment Booklet. This document is used for a number of administrative purposes, including the university's record of your grade. One copy of the form is returned to you with your marked assignment, and on it you will see your mark and a summary of your performance on the whole TMA written by your tutor. You will find a TMA form in this preparatory package.

10.5 *TMA's and your study of MU120*

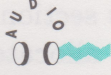
This is an audiotape section to give you an idea of your work in a typical fortnight studying a unit, showing how such the units combine together over the whole course and how your work on TMAs and other course components will fit together. The audiotape band consists of conversation between an MU120 tutor-counsellor and new students.

Now listen to band 4 of the Preparatory Audiotape.

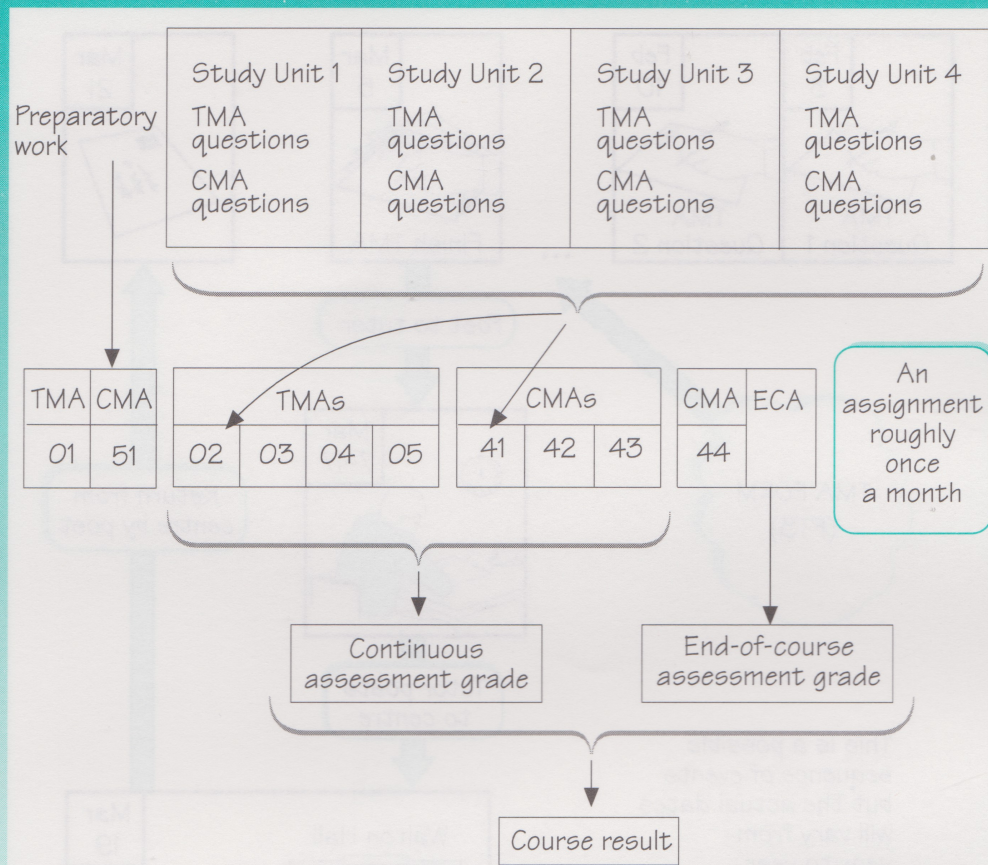


Frame 1

A possible fortnight's study

Sat/Sun	{ Preview Section 1	
Mon/Tues	Section 2	
Wed/Thurs	Section 3	
Fri/Sat	Section 4	
Sun/Mon	Section 5	Tutorial
Tues/Wed	{ Review, rework	
Thurs/Fri	TMA/CMA	

Frame 2



Frame 3

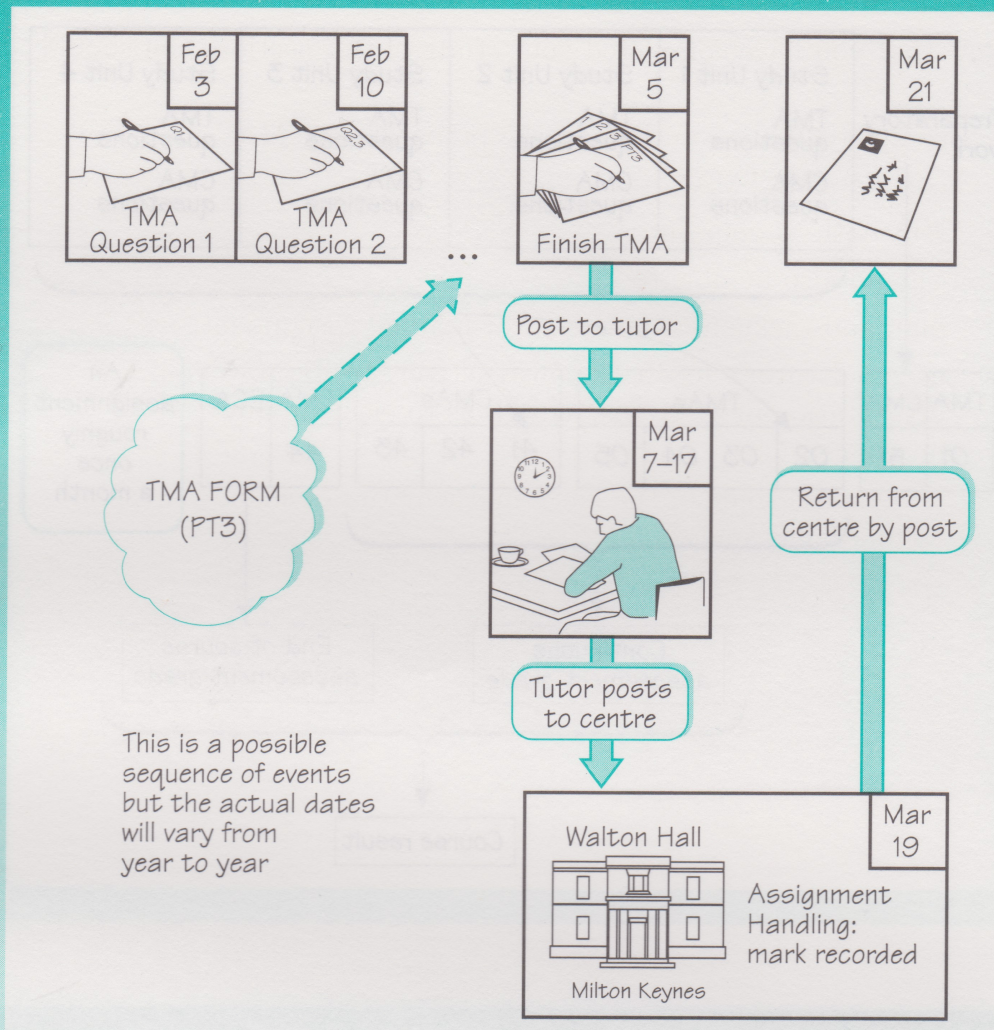
MU120 OPEN MATHEMATICS

2001

OTHER COURSE COMPONENTS						ASSIGNMENT	
Study week	Start date	Course text	Video	Audio	Television	Number	Cut-off date
		POM		Prep Audio		CMA 51 TMA 01	1/2
0	27/1	1	VC band 1	AC 1 bands 1, 2			
1	3/2	2		AC 1 bands 3, 4, 5	TV 1		
2	10/2						
3	17/2	3	VC band 2	AC 2 band 1	TV 2		
4	24/2						
5	3/3	4	VC band 3		TV 3	TMA 02	8/3

This is a sample showing only some of the information for the first few weeks of the course. The details will vary from year to year. You will receive the current edition in your first course mailing.

Frame 4



10.6 Receiving your marked TMA script

The remainder of this section should be read after you receive your TMA script back from your tutor. After your tutor marks it, he or she will send it to Walton Hall in Milton Keynes, where the grade will be recorded. Then the original script will be returned to you. If you want to carry on working now, make a start on Sections 11 to 13 and come back to this section after you have heard from your tutor.



Activity 44 A TMA returned

When you receive your marked TMA, read 'what to do when your TMA comes back' which is on the back of the Preparatory Assignment Booklet. Look particularly at the ten tips and decide which of them would be appropriate for you to carry out now.

Outcomes

Now that you have completed your study of this section, you should have:

- ◇ completed your solutions to the preparatory TMA;
- ◇ completed a TMA form;
- ◇ sent both to your tutor.

You should also be able to:

- ◇ plan and tackle a complete tutor-marked assignment;
- ◇ use your tutor's feedback constructively to improve your presentation of solutions, as well as to clear up any misconceptions;
- ◇ understand some of the basic mathematics of shapes, areas, volumes and angles.

11 Studying and learning mathematics

Aims As you work through this section, you will be

- ◇ drawing together the threads that have made up your preparation;
- ◇ consolidating what you have learned.

People often begin a course of study without really thinking about how they are going to tackle the material—in other words, how they will learn. Over the years, much research has been carried out into the way people learn; there is now much evidence to suggest that if learners are more aware of the processes involved in learning, then they are able to learn more effectively. So what are ‘the processes involved in learning’ and how do they apply to learning mathematics? This section discusses some processes and asks you to think about them as you embark on your study of MU120.

A useful way to start thinking about the processes involved in learning mathematics is to reflect on how you have learned material during your study of this preparatory package. Try to identify two ideas, concepts or mathematical techniques you have learned about and then complete the next activity.

Activity 45 *What, how, why and where?*

Describe in writing two things that you have learned during your study of this preparatory package.

Use the following questions to help you in setting out your description.

- ◇ What did you learn? Was it what you set out to learn? Was it what was intended?
- ◇ How did you learn? Was it by ‘doing’? Was it through reading the text or listening to an audiotape band? Were you learning on your own or as a member of a group?
- ◇ Why did you learn? Was it as a result of using the Diagnostic Quiz or from feedback from the CMA?
- ◇ Where did you learn?

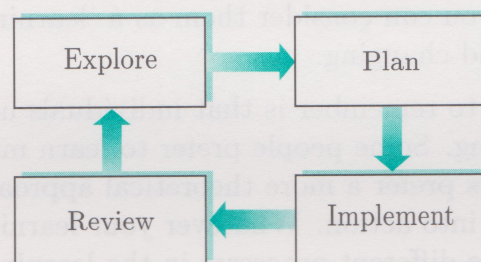
Part of your description included *what* you learned. This process of thinking about what you have achieved is called reflecting on your learning and represents an important part of the learning process, since it allows you to embed knowledge and skills within your own experiences and make them a part of you. By reflecting on your own learning, you become more able to monitor and improve your own learning performance, adapting your approach and style of learning as appropriate to suit the task in hand.

How you go about learning also depends on what is being learned. People learn about mathematics largely through reading, writing, thinking and doing, whereas learning how to swim is largely practical. Most of the learning you do in your everyday life happens through a combination of theory and practice. Similarly, learning on this course requires both elements to be present and both are equally important.

The *practice*—that is, the questions, exercises, activities and assignments—on its own is not sufficient. Without reflection or critical thinking about what has happened, learning may not occur. It is when you think carefully about the practice that you can start to form general rules or theories, which can then help you in dealing with similar situations in the future. So, people do not learn from ‘hands-on’ experiences alone, but from thinking about and reflecting on those experiences.

Similarly, the *theory* on its own is not sufficient. The ideas and theories have to be practised in real examples or situations to see if and how they work. You can then test out your understanding and gain feedback. This may result in some reconstruction of ideas and relationships among them, so that they will work better next time.

So learning involves making connections between *knowing* (the theory) and *doing* (the practice). The following figure shows one way to think about this connection.



Explore

When you begin a new task, you probably often try to find connections to things you have done that seem similar and try to use your previous experience to search out what you already know that is relevant. You may explore the new task, break it down into smaller elements, find bits that you can tackle and then think about the other less known elements.

Plan

Given the task, you may now search out and plan the input you need. This could be reading the next section of the unit, listening to the appropriate audiotape, going back over some previous work or a combination of various forms of input.

Implement

When you have acquired some knowledge, you need to create opportunities for its practice. So you might work on questions, exercises and activities, do the relevant assignment or engage in tutorial activities. This helps to confirm your understanding and, if necessary, you can amend it.

This is where you can use feedback to help you move forward in your thinking. This feedback can be of different types: for example, most of the activities in this course have comments; tutors and fellow students can provide you with verbal feedback comments; TMAs will help to confirm your understanding and provide you with written feedback; and so on.

Review

Reviewing or reflecting helps you to make sense of your understanding, to commit it to memory, to modify your previous ideas, and ultimately to be able to use this new understanding for other tasks.

This idea of learning has important implications, because if you are trying to understand what you are learning then you should make sure you link the 'knowing' component with the 'doing' one. In this way, you build new learning onto existing understanding. Experience is only transformed into learning when it is analysed and processed at the reflection stage. Reflection can help you to deal with new situations if you generalize from particular experience to produce conclusions, which can then be tested and refined as you encounter new tasks. As you learn, these processes—exploring, planning, implementing and reviewing—go on continuously. Thus, you can consider them as a 'learning cycle' that is constantly moving and changing.

One important thing to remember is that individuals use different approaches for learning. Some people prefer to learn mainly by trial and error, by doing; others prefer a more theoretical approach, thinking things through before going into action. Whatever your learning style, you will still be involved in the different processes in the learning cycle and you can use your particular style when completing the required tasks.

Outcomes

Now that you have completed your study of this section, you should have:

- ◇ consolidated what you have learned;
- ◇ reflected on the methods you have used to learn.

12 Outcomes for the preparatory package

Outcomes

Now that you have studied this package, you should have:

- ◇ assessed your mathematical ability using the Diagnostic Quiz and Diagnostic Quiz Solutions;
- ◇ revised all the relevant topics in the *Preparatory Resource Books*;
- ◇ used an audiotape to assist your learning;
- ◇ assessed your own preferred study conditions.

You should also be able to:

- ◇ understand what is meant by the terms 'active reading' and 'active learning';
- ◇ compile study notes appropriate to a learning activity;
- ◇ organize conditions ready for study;
- ◇ use the course calculator to perform basic arithmetic operations;
- ◇ organize and plan a study session;
- ◇ submit assignments, both CMAs and TMAs, and use feedback constructively.

Check whether you have achieved these outcomes. If you have not, return to the relevant part of the package and complete your preparation before the course starts. If you need further guidance, consult your tutor.

13 What next?



Aims This section aims to provide some suggestions for additional activities for you to do if you have time before MU120 starts.

13.1 Active reading, viewing or listening

If you still have some time, before the course starts, you may like to widen your mathematical perspective by indulging in some mathematical reading for fun. There is a wide range of material which has been classified as mathematical, and both public libraries and libraries in colleges or universities will have a selection of mathematical readings. One such article is reprinted in the Preparatory Readings booklet; it is:



‘Games to grow on’ by Claudia Zaslavsky.

If you have time to read this article, try to read actively: take notes and try to summarize what you have read to someone else.

Further items of interest may be found in more everyday material. Often there are articles in the newspapers on mathematical problems, computing and other items of mathematical interest. You might like to build up a scrapbook of annotated material.

You may also like to listen to or watch, actively of course, broadly educational programmes on the radio or television. This will help to prepare you for further learning from the different media used in MU120.

13.2 Consolidation

MU120 will introduce you to a number of areas of mathematics. Becoming familiar with mathematical concepts involves a growing understanding of the concepts and the development of skills in solving associated problems. It is not usual to achieve this understanding on a first reading, so the course adopts what is sometimes called a spiral approach to topics, which means that you will see a particular idea a number of times, at intervals, through the course. In this way, each time you meet an idea, your grasp of it will be improved, so that you will be familiar with most of the ideas by the end of the course. For example, if you look back over your work on the preparatory package, you will probably be able to identify a number of things with which you are familiar now but which were not at your fingertips when you started. The following remark was made by a first-year mathematics student.

I thought that I had mastered that topic two weeks ago but now I cannot remember much about it.

It expresses a feeling shared at some time or other by most students and it may be familiar to you already. If not, it is very likely that you will experience it at some time during the year and it can be very disconcerting. You are likely to find that you may need to revisit some topics several times before you thoroughly understand them. The course is designed to return to topics regularly and this, together with the end-of-course assessment, will help you to consolidate your learning. A useful outcome of the tutorial sessions may be to reassure you that your experience is common to other students too.

You can assist the process of consolidation yourself by using some of the study suggestions discussed in this package. Working on a text need not end when you complete the last page of reading. Before moving on, you could take time to reflect on the content: try to write for yourself a short summary of what it was about. You could try repeating this reflecting and retelling process a couple of weeks later; if you find 'it has gone', scan quickly through the text again to remind yourself of its contents. You might like to try this for some of the preparatory package now.

13.3 The first course mailing

When you receive the first mailing of course material, you will find that it contains the first part of the course. It will be a large package, perhaps in more than one envelope, containing printed units, audiotapes and videotapes, and various other documents. When you receive this mailing, you should first sort out a single sheet labelled Contents Checklist. Go through this list, identifying each item to make sure that you have received all of the material. The Contents Checklist gives instructions about action to take if any item is missing or faulty.

Once you have checked the contents, sort out the material. In particular, pull out the Course Guide, the Study Calendar and the Stop Press.

The Course Guide contains a description of the course and its various components. It follows on directly from your work on this preparatory package and probably you will want to read it as soon as the mailing arrives. Do read it before you start studying *Unit 1*.

The stop presses are multi-purpose documents—like newsletters—and you should read each of these soon after it arrives. In particular, each will probably contain details of any errors known to exist in the course materials. Before you start work on the course, transfer any corrections from the Stop Press to the units and especially to the assignment booklets.

You may like to keep things like the Course Guide, stop presses and the Study Calendar together, perhaps by pinning them onto a notice board.

During the year you will receive further mailings of course material as well as information about choosing your OU courses for the next year. All this will be well into the future and your tutor may discuss these mailings during the year and provide you with any extra help and information which you may need.

13.4 Starting MU120

Once the first mailing arrives, you may want to start work on *Unit 1* before the scheduled start date—but only do so if you have finished working through the preparatory package.

If you have time, it would be good to start your work on MU120 early. Although it has been suggested that your work will occupy roughly six to eight hours each week, like many other skills which you develop, your ability to read course units will improve with practice. You would be wise therefore to allow for the possibility of needing extra time early in the course. So if you are unlikely to find enough time each week in the early part of the course, it would be worth trying to make an early start.

If you do start *Unit 1* early, remember that your first tutorial may go back over this work, among other things: do not expect everybody to have made an early start!

13.5 Sources of help

During your study of the course you are bound to run up against difficulties in understanding the course material—every student does. You should find a number of sources of help, the main ones being your tutor, fellow students and the telephone answering service (which is described in the first Stop Press). Some difficulties will be relatively small, perhaps an obscurity on one page of the unit which prevents your understanding of a section. Do not waste time going over and over the point, but contact someone, perhaps by telephone. Other difficulties may be more fundamental or less urgent. Do make notes about points to bring up at the tutorial sessions or to discuss with other students. This may seem easier said than done. Admitting to difficulties in front of others can be hard. The Open University's 'open' policy means that you may meet students who seem to know a fair bit more than you, but also you will probably meet students who have less mathematical knowledge and confidence than you. Do not avoid asking questions out of a fear of looking ignorant or silly—frequently others will have framed the same question but will be too shy to ask it—your question may initiate a fruitful discussion which benefits everybody. A question suppressed may be an opportunity lost.

Many students form small study groups (of perhaps four or five students) to discuss the course material between tutorials. Members of a group may also be available by telephone for more immediate help, and you can ask your tutor about common difficulties as a group.

Do make every effort to contact your tutor early. If you cannot attend the first tutorial, try to keep in touch by telephone, email, or letter (or by writing notes with your assignments) and make sure that your tutor is aware of your progress. In particular, discuss any major decisions connected with your Open University career with your tutor and/or a Regional Adviser. It is almost inevitable that you will need help of some sort during the course, whether it is with a seemingly small point from a

unit or for permission to submit an assignment a couple of days late. Normally your tutor should be your first point of contact. The Open University has a lot of experience in dealing with students' problems and, if your tutor cannot help, he or she will try to put you in touch with someone who can; it is most unlikely that your position is unique. Do remember that the majority of students complete the course satisfactorily: plan on being one of them.

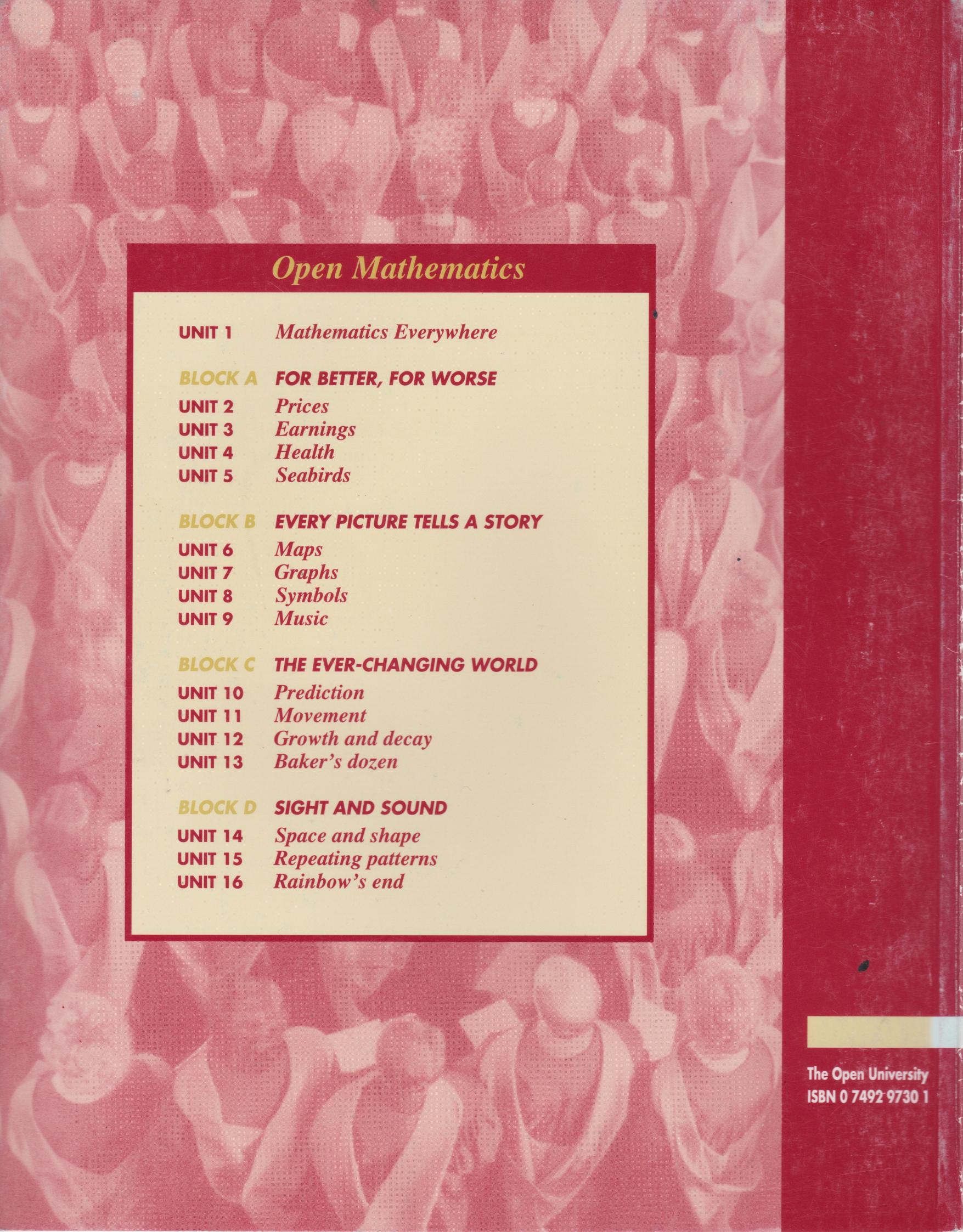
We, the course team, hope that you are feeling confident to tackle *Open Mathematics* now, and we wish you every success with your study this year and in the future.

Acknowledgements

Grateful acknowledgement is made to the following sources for permission to reproduce material in this unit.

Cartoons

p. 37: *Telegraph and Argus*, Bradford; pp. 43, 51: *Sesame*; p. 65: Syndication International, Mirror Group Newspapers.



Open Mathematics

UNIT 1 *Mathematics Everywhere*

BLOCK A **FOR BETTER, FOR WORSE**

UNIT 2 *Prices*

UNIT 3 *Earnings*

UNIT 4 *Health*

UNIT 5 *Seabirds*

BLOCK B **EVERY PICTURE TELLS A STORY**

UNIT 6 *Maps*

UNIT 7 *Graphs*

UNIT 8 *Symbols*

UNIT 9 *Music*

BLOCK C **THE EVER-CHANGING WORLD**

UNIT 10 *Prediction*

UNIT 11 *Movement*

UNIT 12 *Growth and decay*

UNIT 13 *Baker's dozen*

BLOCK D **SIGHT AND SOUND**

UNIT 14 *Space and shape*

UNIT 15 *Repeating patterns*

UNIT 16 *Rainbow's end*